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Forthcoming Events.

APRIL 3.

West of Scotland Iron and Steel Institute:—Annual general meeting at Glasgow.

APRIL 4.

Stoke-on-Trent Association of Engineers:—Annual meeting at Stoke. "The Production of Steam." Paper by W. H. Lake and H. A. Morfey.

Swansea Technical College Metallurgical Society:—Annual meeting at Swansea.

Institution of British Foundrymen (West Riding of Yorkshire Branch):—Annual meeting at Bradford.

APRIL 6.

Cleveland Institution of Engineers:—Ordinary meeting at Middlesbrough.

Institution of Electrical Engineers:—Discussion in London on "Insulation Problems in High Voltage Engineering."

Institution of British Foundrymen (Lancashire Branch):—Annual general meeting at Burnley.

APRIL 7.

West Yorkshire Metallurgical Society:—Ordinary meeting at Huddersfield. "The Selection of Iron by Fracture and Chemical Analysis."

Institute of Marine Engineers:—Ordinary meeting in London. "Steering of Ships." Paper by Capt. P. T. Brown and M. M. Parker, B.Sc.

Institute of Metals (Birmingham Local Section):—Annual general meeting at Birmingham.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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PRESIDENT, 1924-25, R. O. Patterson, Blaydon-on-Tyne.
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Sheffield: R. Village, Albion Foundry, Whittington Moor, near Chesterfield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.
Newcastle-on-Tyne: Colin Gresty, 93, Queen's Road, Monkseaton, Northumberland.
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Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Method of Moulding Drawings and Moulding Machinery in Foundries.

A prominent American foundryman recently asserted that it was impossible under American conditions to make a foundry a commercial success if they relied upon man power only. We believe this is equally applicable to British conditions. There still are, however, a number of foundries which have installed a minimum amount of machinery, may be only some lifting tackle. There are probably less than 100 society moulders unemployed at the present moment, which represents the normal (or perhaps less) of men who are changing their jobs of their own free will. Should the volume of work materially increase in the near future it will be useless to search for additional skilled labour. It was recently asserted that in the Glasgow district it would be impossible for any large foundry to organise a night shift, owing to this scarcity of men. The only alternative is an increased application of machinery. The general tendency of foundry practice is to make the skilled moulder into an assembler of cores. Basically, it is futile to expect a profit from a foundry if the time of its most highly skilled men is taken up in "sand punching"—they are worthy of something better. The Paper by Mr. Ross, of which the concluding portion is given in this issue, presents the science of modern moulding practice in its true aspect. The provision of a "method of moulding" drawing places the trade upon a proper basis for discussion, a factor which has been largely absent in the past. Primarily, the production of such a plan represents the best method procurable from the brains and experience at the disposal of any particular foundry. If there is a change in management, there is a record upon which those who follow can work. In the past far too much foundry knowledge has been centred in the accumulated experience of the individual. These "methods of moulding" drawings indicate clearly which jobs can, and which cannot, be made on a machine. The essentials emphasised are that, in the future, the moulder will be required to use his brain rather than his brawn. The assembling of cores; the closing of moulds, and their running will be the moulder's chief manual work. His main work, however, will be in the standardisation of moulding methods, and his work will bear the same relation to foundry practice as does the jig and tool room mechanic to the machine shop. Moulding machinery has made considerable progress in Britain since the war, but it has not yet covered the whole field of foundry practice. Long moulding machines and complicated core-making machines to eliminate the hand-ramming of core boxes are two phases to which the energies of the equipment people could be usefully directed.

It may be thought that once the system of "method of moulding" drawings is nationally utilised, that the art of moulding, as such, will deteriorate. With this we entirely agree, but conversely, the science of moulding will definitely make progress, because it immediately becomes orderly, articulate, concrete, and comparable, whereas in the past it has been largely a matter of accumulated experience and which, on account of the multitudinous small yet essential operations, infinitely difficult of intelligible expression.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Electric Furnace Practice.

To the Editor of the Foundry Trade Journal.

Sir,—Your article, "The Electric Furnace," by H. Burton Smith, in the current issue of your journal, will be of interest to electric furnace operators the most of whom, in this country, are used to basic furnaces, for the views it contains of an expert in acid electric furnaces.

There are several comments one feels it necessary to make, not so much on the facts presented as on the conclusions drawn therefrom by the author.

The opening statement that "the method of making steel in the electric furnace is somewhat more or less in its infancy" is a hardy annual in some quarters. To-day, however, one must see if the reverse is not the case. Electric steel-making furnaces were used in 1907 by two or three firms who are still using them. Many score electric furnaces have been operated twelve to fifteen years, and hundreds have been installed five or ten years. Statistics are available which show that the output of electric steel obtained from those early days to date is in the millions of tons. The present writer has been responsible for the production of many tens of thousands of tons, and he has not found any less certainty in their production than is experienced in other steel-making processes. The basic electric process is cut and dried in the hands of a skilled worker. In view of all this, it is quite certain that electric steel making is not in its infancy.

Mr. Smith suggests that some magnetic phenomenon takes place in the Snyder furnace, the metal gradually being revolved round in clockwise direction the whole time. You, Sir, add thereto an editorial note that the statement is interesting because it is generally understood that steel loses it magnetic properties on being heated to its first coalescence point.

Most electric furnace designers agree to-day that the present writer's experiments, detailed in the Journal of the I.E.E., vol. 57, supp., October, 1920, p. 275-6, and discussed by several electric engineers in later pages, conclusively proved that in no electric steel furnace did steel circulate by reasons of electro-magnetic influence.

The only electro-magnetic condition which could cause molten steel to circulate in a furnace would be where a continuous magnetic field due to a direct current passing through the bath was at a suitable angle with another continuous magnetic field situated around the molten bath. Such condition cannot at all obtain in electric steel furnaces. The fact that molten steel is non-magnetic does not affect the question, as non-magnetic substances can move as a result of magnetic forces in opposition, *e.g.*, the moving copper coils in most electricity meters.

The last comment to be made is in regard to what the author of your article states as to slag inclusions in electric steel; a point upon which you also make an editorial note. The author suggests that it has been found impossible to free the steel entirely from slag inclusions because of the furnace having a bottom electrode. A glance at the acid electric slag analysis given in the article would almost seem to show the reason for the difficulty he experienced. The presence of over 12 per cent. of ferrous oxide in the finishing slag indicates that the chemically-reducing conditions of the acid electric furnace are not at all equal to those obtaining in basic electric furnaces. The presence of such a high iron oxide content in the acid slag would lead one to expect the most common "slag" inclusion, manganese silicate, to be present in the steel produced under such conditions. Its presence, as you infer, does not result from the furnace having a bottom electrode. It rather points to the impossibility of producing the best electric steels in an acid lined furnace.

Yours etc.,

Victor Stobie.

Dunston-on-Tyne.

Institute of British Foundrymen.

The Junior Section of the Lancashire Branch held its monthly meeting at the College of Technology, Manchester, on Saturday, March 21, Mr. R. W. Stubbs, the President of the Section, being in the chair.

Mr. H. Stead, of Stalybridge, member of the Lancashire Branch Council, gave a lecture entitled "Plate Moulding and the Pattern Maker."

After discussing the work of the patternmaker in general, Mr. Stead then explained the advantages to be derived from plate moulding, and pointed out the effect of plate moulding on pattern making. With the aid of a large number of pattern plates, he illustrated various practical and economic considerations in connection with plate moulding. He also dealt in detail with methods of setting the patterns on the plates.

In the ensuing discussion, in which Messrs. Key, Makemson and the Chairman took part, the necessity for co-operation between the two trades was emphasised. Particular emphasis was laid on the need for the pattern maker to have foundry experience and for the moulder to be able correctly to interpret a drawing. At the conclusion of the lecture a vote of thanks was accorded to Mr. Stead on the motion of Mr. Ollier, and seconded by Mr. Yeoman.

During the evening Mr. Makemson explained the rules governing the award of the John Wilkinson medal. This medal has been presented by Mr. Thewlis Johnson, of Manchester, for competition among members of the Junior Section.

Institute of Metals.

Annual May Lecture.

The 15th annual May lecture is to be given by Professor H. A. Lorentz, of Leiden, Holland, on May 6, tickets for which can be obtained from Mr. G. Shaw Scott, 36, Victoria Street, S.W.1. The subject of the lecture is "The Motion of Electricity in Metals." On April 22 there will take place an election of new members and students, particulars of which can be obtained from the Secretary. The subscriptions of persons then elected will cover not merely the usual period of twelve months, but also the extended period ending June 30, 1926.

American Foundrymen's Convention.

It is announced that the American Foundrymen's Association Convention will this year be held at Syracuse, New York, from October 5 to October 9. The Central New York Foundrymen's Association is interesting itself in the reception of the visitors. Next year (1926), which is to be an international meeting, and to which the Institute of British Foundrymen has received an invitation, is probably being held in Detroit, Michigan, towards the end of September or beginning of October. Should this materialise it will afford the British visitors an opportunity of examining the conditions obtaining in the large automobile foundries situated in that district.

Foundry Exchange Papers.

The exchange Paper issuing from the Association Technique de Fonderie, to be presented at the Glasgow Conference, is being prepared by Mons. André Levi, who is in charge of the Gnome and Rhone Foundry Laboratories. His subject will be "Heat-resisting Cast Irons."

Mr. J. E. Fletcher, consultant to the British Cast Iron Research Association, has accepted an invitation to present a Paper on behalf of the Institute of British Foundrymen to the American Foundrymen's Association. His colleague, Mr. J. G. Pearce, the director, has been selected to present the British exchange Paper to a joint conference of the French and Belgian Associations, to be held in Brussels in September.

The Lining of Pipes and Cocks.*

This article deals with the lining of cast-iron pipes and cocks with these materials for their protection against the action of acids, etc.

Fig. 1 shows a cast-iron flanged pipe lined with a lead pipe. The core for the pipe must consist of a suitable sand and be properly constructed; moreover, when casting the pipe, the iron must not be too hot, in case it should eat into the core sand and produce a rough inner surface. Further, it is advisable to fill the pipe, after cleaning, with a small quantity of a coarse-grained substance suitable for cleaning purposes, and then, closing it at both ends, to turn it rapidly on a lathe, so that it becomes smooth inside. The lead pipe must be driven in firmly and be beaded at both ends into the rims of the cast pipe, which should have been previously turned. The lead pipe having been fixed at one end, a wooden mandrel is driven through the pipe to the opposite end (see Fig. 1), which is then hammered to form a flange. In this way the first beading is prevented from becoming loose. In order that the lead may adhere closely

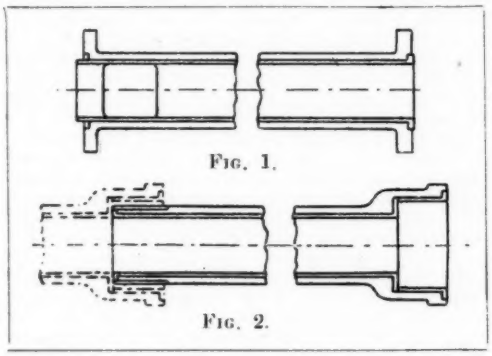


Fig. 1.

Fig. 2.

to the cast iron, the mandrel must finally be forced through the pipe. The rims of the lead pipes must be of the width of the packing surfaces; also they must project slightly towards the flanges, so that the liquid cannot come in contact with the iron.

The socket pipe, in accordance with Fig. 2, is lined inside with lead pipes in the same manner, viz., first the pipe itself and then the socket; also on the outside the pipe, in so far as it enters the socket, must be cased with lead, for which purpose the end of the pipe must be turned. Finally, the joints of the lead pipe must be soldered. If

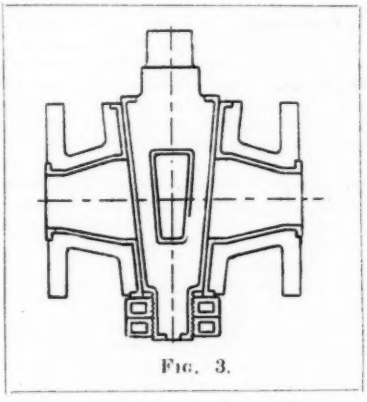


Fig. 3.

no lead pipes are available, the cast-iron pipes must be run in with lead, while using cores. In this case a greater thickness of lead should be provided for, and the pipe should be warmed before the running in, so that the lead lining may turn out well. Tin or vulcanite may also be used in this way for lining the pipe.

Fig. 3 shows a finished cock lined with lead or the like. The cock casing, hollow-turned for this purpose, may be run in with the aid of mandrels (see Fig. 4). The conical mandrel is held by two covers; the upper one is made in one piece with the mandrel and is provided with gate and riser; the edge of the cover engages in the casing, and provides, when the work is accurate, for a uniform thickness of the lining. The two mandrels for the inlet and outlet bear against the conical mandrel;

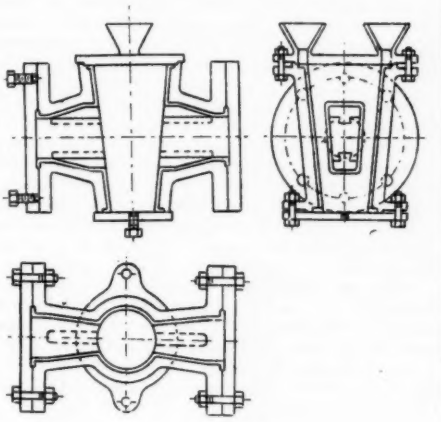


Fig. 4.

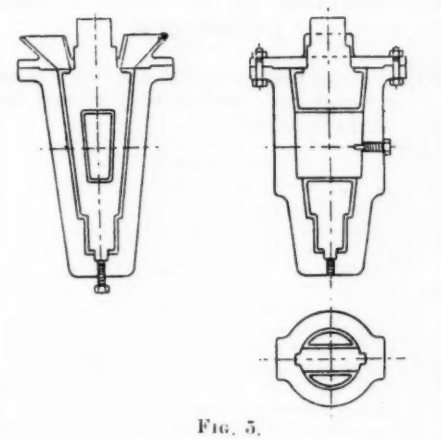


Fig. 5.

they are also made in one piece, with the flanges centrally held by rims. The conical extensions are formed by wedge pieces held in the mandrels by means of dovetailing; the pieces must be pushed into the two lateral mandrels before inserting the conical mandrel. To hold the upper and lower cover, eyes are provided on the cock casing, which are removed on completion of the casing.

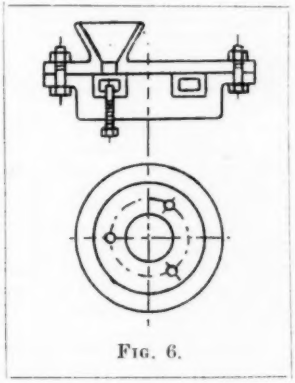


Fig. 6.

After the running in, the mandrels are loosened with the press screws seated in the lateral flanges and in the lower cover.

The cock plug may be run in with the aid of the hollow body shown in Fig. 5. The cover,

* Translated from "Die Giesserei."

again provided with gate and riser, surrounds the plug, and has a rim engaging in the body. The lining in the passage opening is formed by means of a wedge piece projecting into the hollow body. With the insertion of the plug, the piece is brought into the correct position and is then held by a screw. The plug is carried by the upper cover and the lower pin, which projects into the body, so that, with exact adjustment, a uniform thickness of the lining material is again obtained. The press screw fitted below is used to loosen the plug after the running in and the removal of the cover.

The two nuts for adjusting the cock plug are provided with a covering, using the mould seen in Fig. 6. The iron core rests on the screws let into the core; the screws may also be used to loosen the covered nuts. The cover provided with a gate constitutes the upper limit for the mould; it is connected with the latter by means of screws. The remaining three small holes must be run in subsequently.

After the running-in or covering operation, the cock parts are to be finished off. The edge of the lining at the flanges, for the reason already stated, must be as wide as the packing rings; it may project or recede, the chief requirement being that the rings shall rest on the edges. Details are shown in the illustrations.

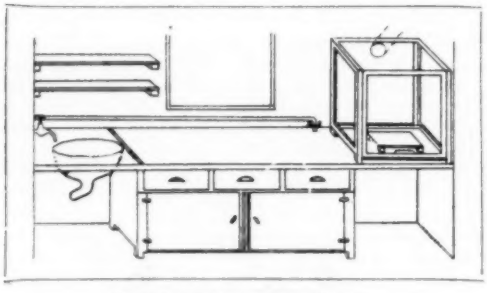
Construction of a Small Foundry Laboratory.

Points on an Economical Method of Providing a Bench for Analysis of Iron and Steel-works Material.

By "Celbian."

Many owners of small foundries labour under the impression that a laboratory is a very costly affair, and that for all the analysis they require it would be a scarcely justifiable outlay. That this is an error the following article is intended to portray.

When the construction of a small laboratory is under consideration it is necessary to select a suitable spot where water and gas supply are available. Any odd room which has good light and is well ventilated is to be recommended. Most works laboratories are built apart from the general buildings, or on the top storey, so that in the event



Proposed Chemical Bench.

of fire there will be less chance of it spreading. This latter precaution is scarcely necessary where the following small bench is constructed. If it is decided to go the length of providing a small house, the ceiling and floor should consist of wooden planking. Ordinary plaster ceilings are apt to allow small loosened particles to fall into the receptacles used, rendering the analysis inaccurate. Stone or concrete floors are undesirable, as the breakage of glass is much greater annually than with floors of wood.

A single wooden bench extending along one side of the room will be sufficient for the manipulation of all tests. Two or three rows of shelves are fitted to the walls for holding the lighter bottles, a space below the bench being kept for the heavier bottles or jars. Three well-made drawers are fitted to the bench, and should be capable of opening and shutting without causing any vibration to the bottles, etc., placed above. At one end of the bench a small sink is made out of sheet lead and provided with a discharge pipe connected to the drain.

The gas supply is fitted to a T-piece, from which the gas may flow from two or more orifices, each of which is furnished with taps to regulate the amount. A fume cupboard is constructed at the opposite end of the bench from the sink, occupying the corner at the wall. This essentially consists of a rectangular case of glass (wood framed), with a glass door and vent at the top, which leads the gases into a flue or directly to the roof. Inside the case a thin iron plate upraised on supports is fitted or placed on top of a gas burner. This hot plate is used for the evaporation of dishes of liquor, and when these emit objectionable odours the door is shut, and all fumes pass up the chimney. Two ordinary cupboards are built under the bench, one of which is used for storing stands, tripods, and all heavier pieces of apparatus.

All glass and porcelain apparatus are stored in the second cupboard; light apparatus and appliances, such as corks, tubes, filter papers, etc., are kept in the drawers. The balance should be placed on some other bench or piece of furniture which will not readily lend itself to shock or vibration, as this might cause inaccurate weighings to be recorded. When the equipment of a testing bench is left in the hands of laboratory furnishers these are inclined to supply a multiplicity of apparatus that is scarcely necessary when the analysis of foundry material only is to be conducted.

It should perhaps be added that a bucking board for crushing ore, bricks, slag, etc., to small pieces has been omitted, as equally convenient means of pulverising are usually to be found in most works. The customary practice is to conduct all pounding and grinding processes in another department, or at least as far from the testing bench as possible, as otherwise the vibration will be a constant source of trouble, with bottles dropping from shelves and other breakages occurring. The temperature of the room should not be allowed to fall to too low a degree, as the glass used is much more readily broken. As the acids employed are capable of attacking almost any organic matter, it is unnecessary to have the floors covered with linoleum, wax-cloth, paint or varnish. In some instances the bench is varnished, but a better method of protecting it is to first stain the wood and then apply several coatings of linseed oil.

Provided that a small house or room is available, the total cost of inside fittings, apparatus, and a moderate supply of chemicals should not exceed £50.

Catalogues Received.

Cast-Iron Pipes.—The April stock list of cast-iron pipes issued by the Staveley Coal & Iron Company, Limited, Chesterfield, is now available.

Refractories.—The Consett Iron Company, Limited, of Consett, County Durham, are circularising the foundry trades with two circulars dealing with silica bricks and "Delves" fire-bricks.

Tank Gauge.—Messrs. Negretti & Zambra, of 38, Holborn Viaduct, London, E.C.1, have sent us a new catalogue which describes and illustrates a new development in industrial instruments—a dial and distance tank gauge. The dial gauge can be used for indicating or recording height, weight, or volume of all types of liquids. For steel and other foundries using fuel oil for heating purposes we would advise that they should procure a copy. The catalogue takes the form of a 12-page well-illustrated brochure, printed on art paper.

Catton & Company, Limited, Yorkshire Steel Foundry, Hunslet, Leeds, announce that the firm has now been established 50 years.

Mr. F. A. Klouman, a member of the London Branch of the Institute of British Foundrymen, has been appointed manager of the hydro-electric department of Messrs. J. Blakeborough & Sons, Limited, of Brighouse, Yorks. He was previously personal assistant to Mr. James Bibby, of Messrs. Wellman, Bibby & Company, Limited, of Kern House, Kingsway, London, W.C.2.

Foundry Planning for Economical Production.*

By Evan J. Ross, Holm Foundry, Cathcart, Glasgow.

(*Continued from page* 263.)

Pattern Shop Practice.

There are a few general instructions which the pattern shop must work to. The patterns and core-boxes must have a better finish than for hand moulding, particularly as to joining of timber, general finish and painting. All fillets, when possible, are put on the patterns and in the core-boxes, either cut out of the solid wood, which is expensive, but is undoubtedly the better way, or made up of a plastic material. For a standard pattern, from which, say, batches of from 12 to 24 may be made, the fillets should certainly be cut out, but where the batches are smaller, and perhaps not so often called for, the fillets may be made up. This is a point which can only be decided when design and quantity of castings are considered together. Patterns need not always be of heavier construction for use on machines, but the internal construction should be arranged to permit of patterns being well secured to plates. In jolting and vibrating they certainly have to withstand a very severe strain, but this is evenly distributed, and not so destructive as in the case of hand moulding, when a hammer is used on internal bridges and ends.

It is essential for speed in coring that all core prints fit exactly in the drag mould, therefore patternmakers must work with a much greater degree of accuracy than is usually the case where stamping, carding, shaving of moulds and sprigging is constant *practice*.

For ordinary foundry practice patternmakers generally make prints on patterns larger in diameter than actual core print, necessitating the closer adjusting the core. This means stamping and sprigging, thus taking time which is additional on the production of the casting. Accurately fitting cores prevent metal from passing over the ends of cores and stopping venting.

Again, patterns very often show a lack of consideration of the foundry, by the length of prints on patterns for very large cores. These are often made too short to give sufficient surface to transmit the upward pressure to the mould.

On account of the lighter designs now put forward, and of a reduction on machining allowances, cores must be truly registered and held in position. Pattern-making costs are, on the whole, higher, but the more intricate a pattern, or to take the other extreme, the simpler a pattern, the nearer is the cost of planned patterns to that of patterns for ordinary methods. There is a saving in the cost of repairs to patterns if used on machines, and this must not be overlooked when initial costs are considered. The quality and construction of patterns can be graded for machine work, depending on the number off just as patterns are graded for ordinary methods.

The next few figures illustrate a few closing, core-locking and registration devices to facilitate speedy coring and closing of moulds. Fig. 14 shows a circular end print for a mould when cast horizontally. Complete circular prints are only made use of when the core is fairly short, in comparison with the diameter. When two half patterns are necessary the core fits exactly in the drag mould, but the cope mould is made clear on sides and end to avoid a crush. The cope mould bears on the core print for about one-third of the circumference. This is allowed for in the construction of the pattern, and is worked to in all cases wherever possible. When a circular core is of considerable length, and the upward pressure due to the displacement of metal becomes very great, it is always better to transmit same to mould by a flat surface. Fig. 15 is of a round core with a flat on the print. Clearances in cope mould as shown are arranged for on pattern.

If a core has projections, or must be set very true, it becomes necessary to make print as Fig. 16. The taper on this print is made such that, when lowering the core into mould, the print will touch the mould before any projecting part fouls other cores or side of mould. A print of this type is very good practice when an adjoining core is hidden or hung in the cope, as it ensures accurate matching. The length of such prints is usually about one-third of the breadth for large cores, but in the case of a small core, say, 1 in. dia., the length would be 1½ times the diameter, and the diameter of print would also be enlarged, as shown by Fig. 19 print B. This enlargement ensures a better seating. also, when small cores have small prints, there is a tendency for the sand to fritter or crumble away.

Fig. 17 shows how scraping of mould or filing of core is eliminated when coring vertically or closing over a core. The core print fits at casting, but is clear at end of print. When a horizontal core has a blind end, Fig. 18, it is advisable to make sure that the core cannot be inserted too far. This is prevented by the bridge of sand at A. In some castings chaplets are not permissible, and when such is the case the core print is made heavy enough to counterbalance the overhand, and prevent the core from tilting, thus avoiding sprigging and perhaps a crush when closing.

To prevent the necessity of thicknessing, and ensure proper alignment of internal horizontal cores which butt, Fig. 19, a keyway and key are arranged for, in core-boxes of adjoining cores. With such a registration device it is necessary to have clearance at the external print in the drag mould, to allow of lowering the core to correct level before sliding the key into keyways.

Fig. 20 is an illustration of how two cores, one vertical and the other horizontal, are truly registered in all directions to one another. Fig. 21 illustrates how a port core for a steam cylinder casting is registered into main barrel core. This is for a mould closed horizontally. The port core is of a fairly narrow section, but the print is given extra width, ensuring better registration, and also a more secure anchorage for the core iron. Each of these devices, and many others are used in various forms and in various ways, as the type of core or mould demands.

Contraction.

When a standard product warrants the additional expense of metal patterns and core-boxes these are designed as an ordinary engineering job, and finished with tool room precision. In figuring up the pattern details for it, contraction in the castings is allowed for, but not the usual pattern-shop rule contraction for iron, 1/10 or 3/32 per ft. all over. The contour of the casting and direction of contraction is considered. In an ordinary cylindrical casting the lineal contraction may be ⅛ per ft., but in the diameter only 1/16 per ft. In some instances it is better to neglect contraction, such as in a casting having three circular sections connected to one another. Each circular portion contracts towards its own centre, but the contraction between the centres is negligible. These centres would be made to standard rule, and the allowance in each circular section would be 1/16 per ft.

The various points in the foregoing general description of the smaller details in planning, along with points Nos. 1, 2 and 3 can now be more fully dealt with.

Fig. 22 shows an arrangement of a mould for cast iron casting. The duty of this casting is comparatively light. The casting weighs 11.5 cwts. Each half moulding box is 7 ft. × 4 ft. × 2 ft. deep.

As to the "Ways of making the mould" there are obviously two ways in which this may be moulded. One is with the open door down, and the other as shown. The door face is a machined face, and generally, machined faces are arranged either down or vertical, thus ensuring a perfectly clean joint on machining. The disadvantage of having this face up is the possibility of dirt floating to top of the mould and showing in the machining. To meet such a contingency the machining allowance may be increased by 1/16, ⅛ or 3/16 in., depending on the size and shape of casting. The more complicated the inside of a mould, the greater is the possibility of dirt accumulating and rising to any machined faces, therefore, any additional machining thought necessary

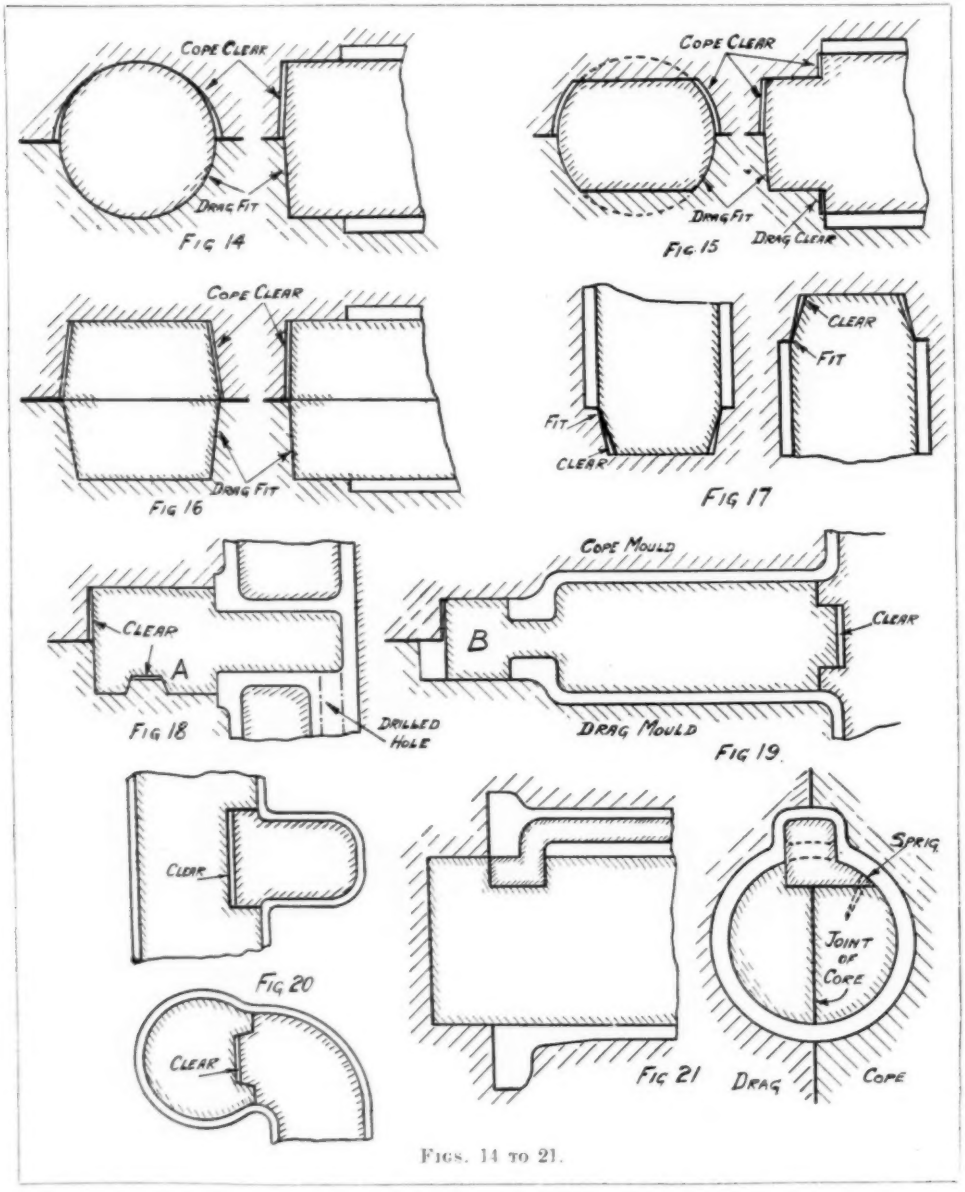
* A Paper read at a meeting of the Scottish Branch of the Institute of British Foundrymen, Mr. James Affleck presiding.

is marked on "Method of Moulding" drawing for patternmaker. In a mould such as this, having a simple contour and only one internal core, 1/16 in. addition machining on door face is quite sufficient, i.e., ¼ in. machining in all.

Undoubtedly the greatest problem with this mould is the floating of the core. If the door were cast-down, this would necessitate anchoring the core from the core iron, to the underside of the drag box bars, an operation which takes considerable time, and for which provision must be made when making the core. By making the mould as shown advantage is taken of the core in bearing direct on the cope mould thus eliminating the necessity of anchoring.

gases have a direct flow up through the cope mould. The gear required for this casting necessitates the use of two half-patterns and two half-coreboxes. Actually special core irons were designed.

The end print B (Fig. 22) is made rectangular in this case, to ensure that when the complete core is in position, the inside of vertical wall of door will be parallel to the outside of the wall made by the cope mould, thus giving an even metal section. The cope half end-print B is made rectangular to obtain a large flat surface to transmit its full share of the upward force due to the displacement of metal. The core is made in two parts—A1 and



FIGS. 14 TO 21.

In considering the type of mould most suitable, i.e., either green sand, or dry sand, the simplicity of contour and absence of numerous cores lend themselves to the advantage of a green sand mould, but this, however, has disadvantages, due to the size of mould, shape of casting, and imperfections of machines which outweigh any advantages.

It is evident that there is only one way of parting this pattern no matter whether the mould is cast with the door up or down, and that is longitudinally as shown. An alteration in design as illustrated by Fig. 3 was carried out on this casting. In this particular casting there are no points which are liable to cause draw, as the metal thicknesses are very even all over. Venting is satisfied by having the open door up the core when the

A2, these parts being turned out from coreboxes on to flat plates on joint face where indicated.

Coring.

In coring A1 is inserted in drag mould, then A2 is placed on top, being lined up by edges of halves matching. Clearance is allowed for on ends and sides of cope pattern prints, thus eliminating the necessity of cutting clearances in mould or may be crushing. The mould is now closed and runner and riser boxes arranged for pouring. For such a casting as this the pattern shop only get the general outlines of the cope and drag, and also some general particulars of the prints, additional machining, or any other special features thought necessary. No elaborate drawings, however, are necessary.

Fig. 23 is a section of mould for a steam turbine nozzle segment casting. The number of nozzles in a segment may vary from four to twelve. This casting, the most important in the manufacture of a turbine, demands the greatest care and precision. The registration and alignment of nozzle cores in master core is illustrated by Fig. 13. The casting is made completely in the drag mould, thus cutting out any minute discrepancies which are possibly due to inaccuracies of moulding box pins. The contour of the master core is parallel with the edge of the flange of the segment, except for registering keys as illustrated. These three keys fit exactly in mould, but the mould is otherwise clear of master core round the edge. This gives the most accurate location, *i.e.*, a three-point location. The mould at the outlet of the nozzle is also ample clear to avoid

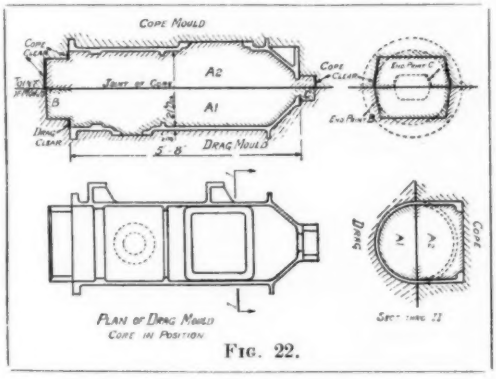


FIG. 22.

scraping when placing the master core in position, the nozzle cores being entirely hidden.

Such castings formerly made in dry sand moulds are now made in green sand moulds, as all the features which are liable to result in inaccuracies are controlled. The principle of this arrangement may be applied to turbine nozzle segments cast in nickel steel or other sheet metal blades.

Fig. 24 is an arrangement of mould for a cylinder casting, the internal diameter of which is 16½ in. The walls are ½ in. thick, and the weight 5 cwts. This mould is built of cores G, H, H, J, and these cores are made entirely of silica sand. No moulding boxes are used in making this casting. This type of mould is very suitable for castings where accuracy and weight are two very important factors, also when more than a two-part job the expense of making mid part boxes is dispensed with, which is a consideration when there are not many castings to make.

The casting was designed as shown, but altered to reduce pattern-making costs and facilitate moulding. By making the water chamber symmetrical about the centre line Y Y only one part pattern is required for making cores H, H, *i.e.*, three part patterns in all G, H, J, and it also cuts out the manufacture of a half corebox for core C. The boss, as indicated, is duplicated, thus preventing handling when making cores H and C; also eliminating the possibility of error when building.

The external cores, all equal in depth, are made in a "Universal" corebox, *i.e.*, a corebox which is designed to take any pattern within its range of diameter and depth. Maximum depth of pattern permissible is depth of box, but to accommodate shallower patterns a false bottom is inserted. The changing of a part pattern is only the matter of a few moments, and does not necessitate disturbing the box or fastenings while on the machine table.

Manufacture of Complete Mould.

All cores are turned out on to flat-plates at joints of cores, as is indicated by heavy lines.

External Cores.—Part pattern J is fixed in the universal corebox and one core made; the part pattern H fixed in the universal corebox and two cores made, and finally part pattern G fixed in universal corebox and one core made.

Internal Cores.—Two half cores are made from corebox A, the halves are pasted together, a loose downgate, and the runners are in the box; two half cores are made from corebox B, the halves pasted together, the loose downgate being in box; core B is made $\frac{1}{16}$ in. short to allow for the settling of the external cores when drying; two half cores are made from corebox C. They are not pasted, and must be put into the mould separately; four half-cores from corebox D, and the halves pasted together; eight half-cores are rammed up from corebox E, the corebox making two halves in one operation, *i.e.*, the right- and left-hand halves which are pasted together and then pasted in position in cores C; two cores are made from box F and pasted to core B.

Building.—Steel channels are laid in position on the floor, and core A is placed upon them and levelled. Then core J is placed over A, the latter being registered by the extended prints on the short pipe bend at the foot of core A. Core H can then be placed on J and registered by the alignment recesses as shown in the plan.

One half-core C is now inserted, and registered by prints into core H. Then complete cores D are placed in position and registered by prints into cores H and A. The centre print of core D is the only one which fits at the sides, thus permitting any slight discrepancy in the exactitude of core adjusting itself. The prints of core D, registering in core A, are clear in the inside as shown.

The second half of core C is now placed in position, lining it up by the matching of the edges on the lower half of C. The top-core H is placed in position, and then core G is positioned. The complete core B is now inserted, having cores F attached. The top channels are positioned across the mould, and four 1in. dia. bolts are tightened up, thus binding the mould together. Loose sand is inserted under the mould to prevent any sagging of the cores due to the weight of metal. The runner and riser boxes are now placed in position, and the mould is ready for pouring. These castings are run as shown—a method which has been found very satisfactory for castings of this type.

Fig. 25 is an illustration of a partly machined Diesel engine cylinder, and Fig. 26 is a typical example of a "method of moulding" drawing for such a casting. This latter illustration, to make it readily understood, is much more fully detailed than an actual drawing would be. This casting, described in its simplest form, is composed of an internal cylinder joined to the external casing, which is partly rectangular in form, by ribs and also by walls of the scavenge and exhaust ports. Due to the size and importance of this casting, it is considered advisable to make this a dry sand mould. The casting is run with the mould in a horizontal position. The pattern is parted along

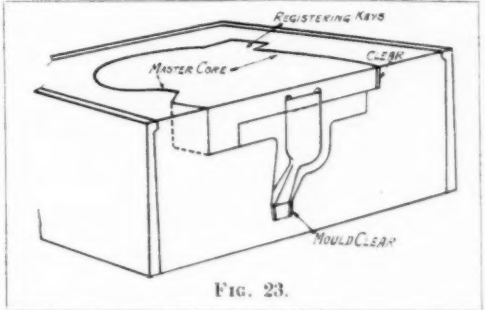


FIG. 23.

joint of the mould. There are one or two points in the design of this cylinder which necessitated special provision for simplicity of manufacture and closing of mould. Four oval facings were made to draw direct from the sand, as illustrated by section III, III, otherwise these facings would have been loose on the pattern, thereby running more risk of an imperfect draw.

As it is, there are still three facings, two circular and one oval (see section through pattern), which are too large to permit of straightening to draw. These are checked into the pattern, as shown, allowing the pattern to draw clean away, after which the facings are picked out of mould. The sand on the underside of these facings must be hand tucked. Section II, II shows where the cope and drag moulds are given clearance for

closing from the extreme points of cores C1 and C2. This is the point which governs the taper of the end prints, as shown by the end view of the pattern. The rectangular print also ensures cores C1 and C2 matching with C3, which are blind for coring and closing. The internal length of core C3 is governed by the internal radius of the casting, as illustrated by longitudinal section through VI, VI. To hold securely the various very irregular shaped cores, forming the water jacket, and to ensure the speedy coring of the mould, the internal keys and external prints are arranged as the illustrations indicate. *Chaplets in this mould are entirely dispensed with, as the cores cannot move in any direction; also thicknessing is quite unnecessary.* The gear necessary and the order of coring mould is fully detailed on the illustration. The various core boxes for this job were illustrated

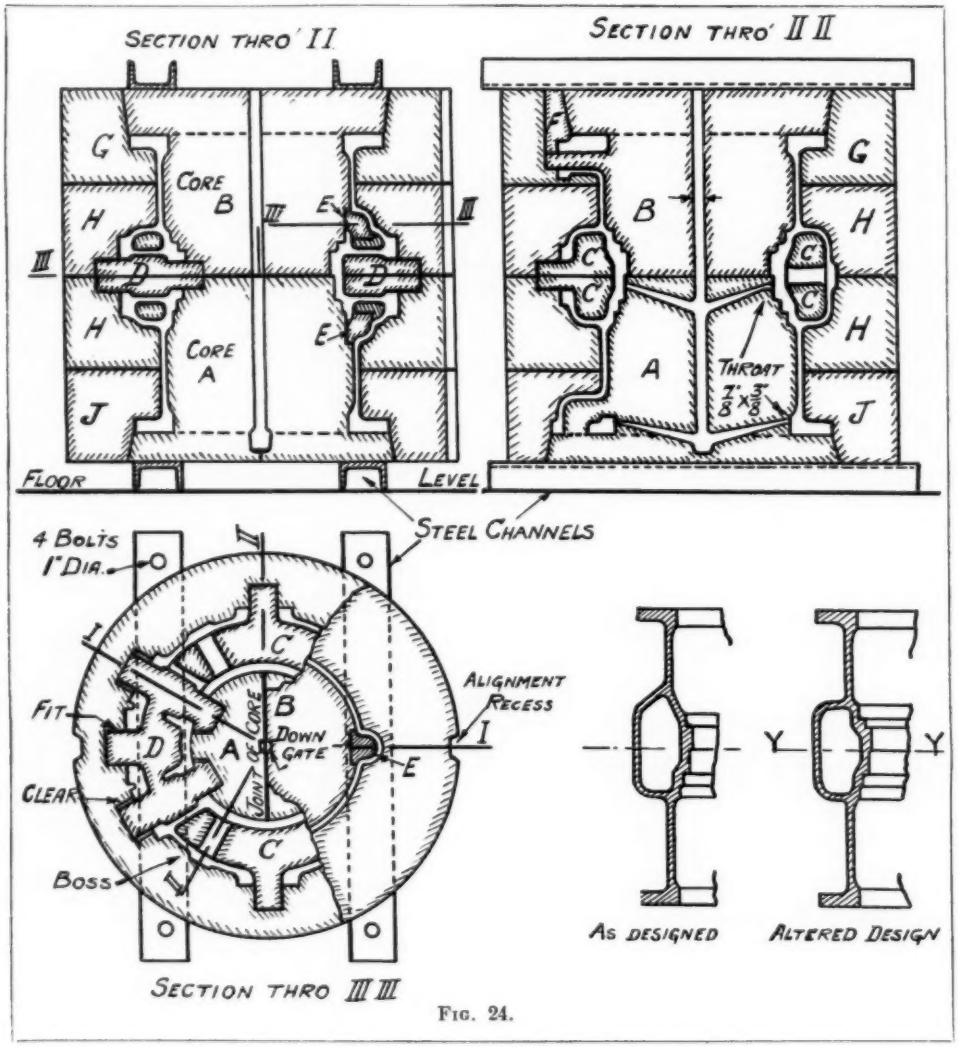


Fig. 24.

by drawings showing arrangements of removable and loose pieces, which drawings were issued to the pattern shop. The dimension lines on the drawing are dimensions which are fixed for the patternmakers. The overall length and maximum breadth of pattern over prints are controlled. Length of all prints are fixed. The dimensions on left-hand end of the plan controls the position of the pattern in the moulding box to suit the ribs. The depth of the core F is made to suit the maximum depth of the pattern permissible in the moulding box. The clearance in the cope mould is provided on the cope pattern, on end, and the sides of all prints, but the mould is made to bear on top of core prints.

As cores F are fixed in position in the drag and cope moulds and ½-in. clearance is allowed between the cores F and the main core A to prevent scraping when closing, the main core is positioned longitudinally by the projecting prints at the right-hand end where marked "FIT," and is positioned transversely by the end prints. The manufacture of cores for this mould is as follows:—Half cores, A1 and A2, which are turned out on to flat plates on the joint-line faces are made from one corebox, having prints interchangeable for handing, also having vertical pins making the bolt holes.

Core B, which is practically circular, is turned out on a sand bed, the open side of the corebox being the internal face of core, which face is strickled, the alignment of strickle being governed by a central runner fixed on the box, ensuring a true surface. The open sides of coreboxes C1 and C2 are in this case the external faces which are strickled and cores turned out on sand beds.

Cores C3 are turned out on the larger flat face; core D, made in two parts, D1 and D2, both of which are turned out on flat faces of joint as shown in the plan and are pasted together; core E is turned out on the left-hand side, looking on plan of mould; core F, of which there are two parts, one being in the drag and one in the cope, is turned out on the end flat face.

When the various cores are hung on the main core A in the order given on the illustration, the eye bolts are screwed on the two end bolts which hold the halves of core together. Slings are slipped through the eyebolts and over the ends of the moulding-box lifting-beam. The assembled cores, when suspended, are levelled and then lowered into the drag mould. The cope mould is now lowered on, guided by accurately fitting locating pins. The runner and riser boxes are arranged thus, making the mould ready for pouring.

Fig. 27 illustrates two arrangements of a mould for a cylindrical casting. This casting has an opening at each end, set eccentrically to the centre

line of the main body. A casting of this design, say 4 or 5 ft. dia. and 4 or 5 ft. long, in a moulding box or pit would require to be run as moulded. In the top view the joint of mould and parting of patterns, if parted, lie on line A.B. This is the simplest way to make this mould, but from a

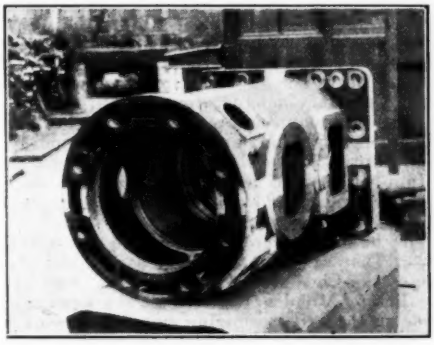


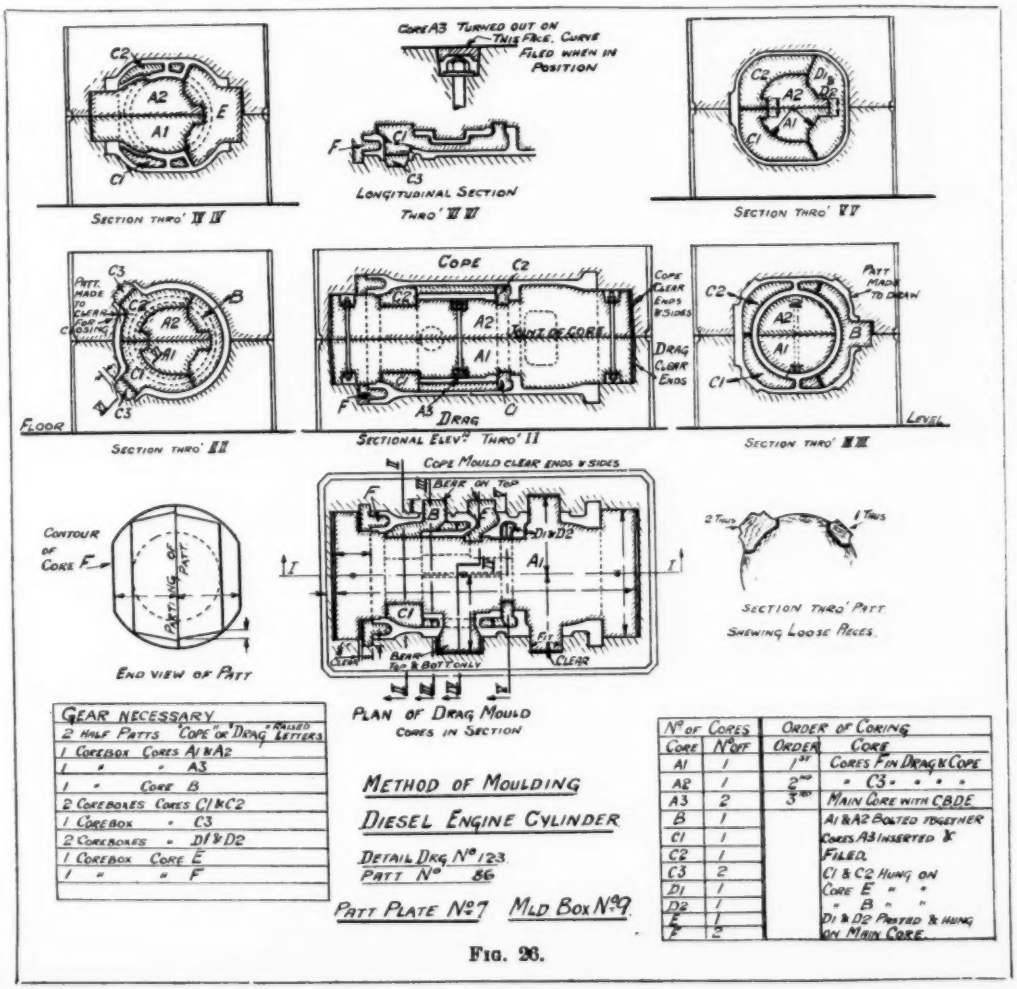
Fig. 25.—Partly Machined Diesel Engine Cylinder.

consideration of foundry facts it is not by any means the correct way. When the metal is run into the mould, the core on floating has a rotational direction as indicated by the arrow Y, the centre of rotation being the centre of the opening, *i.e.*, the point of intersection of centre lines A.B. and C.D. To hold the core in position by chaplets or other means is a most unsatisfactory arrangement, the upward force not being direct but having a tendency to displace the fixtures. The thicker the metal the greater is this tendency. In coring there is also the difficulty to be overcome of the heavy side of the core drooping. In the bottom illustration, the joint of the mould lies along line E.F. With the centre of the opening and centre of the main body of the casting in a vertical line, the upward force is direct as is indicated by arrow Z—a force which can be readily controlled at end of the core by prints or bar. This arrangement certainly takes more time to make the mould, due to the difference of levels between centre of the opening and centre of the main body, but the core is much more easily handled and more quickly positioned. An even thickness of metal may reasonably be expected.

Advantages of the System Outlined.

There are a few outstanding advantages which foundry work carried out in the manner described has over the ordinary methods:—

(1) From the "Method of Moulding" drawing, a very accurate estimate of the pattern-making costs is obtained, as each pattern and corebox can be visualised and the necessary timber and time of construction readily calculated; (2) the time required to make moulds and cores, the time of closing, and the amount of sand used can be accurately estimated; (3) very many castings, both simple and intricate, which were formerly made in drysand moulds, can be made in greensand moulds; (4) dressing costs are reduced to a minimum, due to the accuracy with which moulds come from the machines and accurately fitting cores; (5) the time of production shows a considerable reduction when compared with the time for similar castings produced in the ordinary way, which induces quicker deliveries. This is a point which becomes more evident every day and may be stated thus: The more intricate the casting, the greater is the difference in time of production between ordinary foundry methods and planned methods; (6) the weight of the castings turned out is the correct weight and not from 5 to 15 per cent. too heavy, as with ordinary foundry methods. Engineers are always complaining about the excess of weight by which castings exceed the calculated weight. If quotations for castings are based on calculated


Core A3 Turned out on this face. Curve filled when in position
Section thro' II II
Longitudinal Section thro' V V
Section thro' VI VI
Section thro' III III
Sectional Elev.n thro' II
Section thro' IV IV
Cope Mould clear ends & sides
Bear on Top
Bear on Bott only
Clear
Contour of Core F
End view of Patt
Plan of Drag Mould Cores in Section
Section thro' Patt shewing Loose Pieces
Floor
Level
Cope
Drag
Joint of Core
Cope clear ends & sides
Drag clear ends
Patt made to draw
Patt made to clear for closing
Parting of Patt

Gear necessary	
2 Half Patts "Cope" or "Drag" Raised Letters	
1 Corebox Cores A1 & A2	
1 " " A3	
1 " Core B	
2 Coreboxes Cores C1 & C2	
1 Corebox " C3	
2 Coreboxes " D1 & D2	
1 Corebox Core E	
1 " " F	

Method of Moulding

Diesel Engine Cylinder

Detail Drg. N° 123.
Patt N° 86

Patt Plate N°7 Mld Box N°9

N° of Cores		Order of Coring	
Core	N° off	Order	Core
A1	1	1st	Cores F in Drag & Cope
A2	1	2nd	" C3 " " "
A3	2	3rd	Main Core with C B D E
B	1		A1 & A2 Bolted together
C1	1		Cores A3 inserted &
C2	1		Filed.
C3	2		C1 & C2 Hung on
D1	1		Core E " "
D2	1		" B " "
E	1		D1 & D2 Pinned & Hung
F	2		on Main Core.

Fig. 26.

weights and these weights are exceeded, there is a direct loss equal to the excess of metal in the casting—metal which the engineer does not want; (7) economy is not all entirely on the foundry side, as many ports and passages formerly necessitating machining are cast with an accuracy which eliminates machining operations, thus permitting of rapid production in the machine shops: and (8) the regularity of contour and very true alignment of the castings allow jigging for machining. If the castings are machined without jigs or, if marked off on the surface table, there is a considerable reduction in the time of setting.

Conclusion.

If foundrymen wish to have the various troubles and difficulties due to design overcome, they must bring every one of them to the notice of the designing staff either by direct explanation or sketches showing alternative methods, the latter being undoubtedly the better way. This entails that foundrymen must be able to read drawings and make sketches.

The designing staff will always give full consideration to any alteration towards cheapening

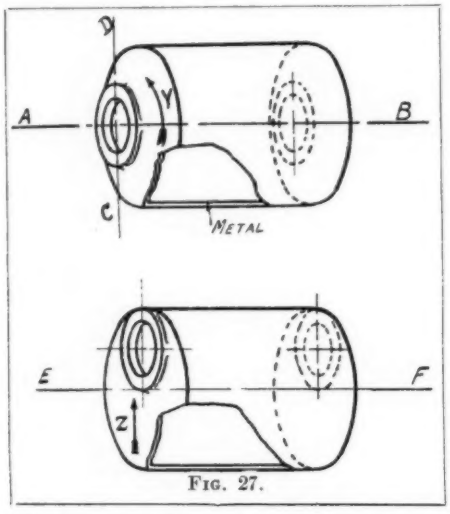


Fig. 27.

production or making a good job better. That is their business, and they are always anxious and willing to learn, their training making this a kind of second nature. *For a considerable time now there has been a persistent call for co-operation between the drawing office, the pattern shop, and the foundry, and this scheme, as outlined, is at least one way of accomplishing this end.*

One of the essential features for the successful carrying out of this work is a fairly extensive general engineering training; that is, a general knowledge of the technical side of design and a knowledge of the duties for which castings are designed. A knowledge of machining methods is also a great asset.

In concluding, the author desires sincerely to thank the directors of the Argus Foundry, Limited. for kindly granting him the privilege of describing their methods, also to thank Messrs. G. & J. Weir for allowing him to use drawings of their products as illustrations—kindnesses granted in the interest of general foundry progress.

Training of Indians in Metallurgy.—The Jamshedpur Technical Institute, opened by the Tata Iron and Steel Company in 1921 with a view to training Indians to hold superior positions in their works, has borne good fruit. So far 15 students have completed their course of training; two of these having been trained for the Mysore Iron Works, at the expense of the Mysore Government, returned to Mysore. The remaining 13 have been employed by the Tata Company in the following departments:—Blast furnaces, 4; open-hearth, 3; Bessemer converters, 1; rail mills, 3; special training, 2. The Institute has attracted many students from all parts of India, and the rigorous selection maintains a very high standard of efficiency. The Institute is supported by grants from the Company and the Governments of Bihar and Orissa, Bengal, Punjab and Mysore

A New Chinese Iron and Steel Foundry.

Industrial undertakings in China have for the last few years felt the need of a modern machine shop in that country which could make heavy machine parts and castings of a quality equal to that of imported machinery. Now the want has been supplied by the Chee Hsin Engineering Works at Tongshan, on the Peking-Mukden Railway. The works have been erected by the Chee Hsin Cement Company, for the purpose of promoting the manufacture of such machinery and machine parts which can be made economically in this country for local industries. The machinery output will be specially adapted for the manufacture of cement, and other special machinery will, in due course, be turned out.

The buildings were completed in the spring of 1923. They are situated to the east of the present site of the Chee Hsin Cement Works, bordered by the Peking-Mukden Railway on the west and the river on the east, occupying over 150 mow of land.

There are six principal producing departments, namely, machine, forge, riveting, pattern, iron and steel foundries, with an aggregated floor space of over 70,000 sq. ft. Besides, there is a store for raw materials, one for patterns, a general office, and a dormitory. The principal buildings are built with sawtooth roofs, so that ample light is afforded for working. They have reinforced concrete columns and beams with brick walls, and are therefore quite fireproof.

The shops are provided with the heavy type of turning, planing, plate machinery and equipment, capable of handling the making of heavy machinery as used in most industries. Both grey and chilled iron castings are made in the foundry. Castings as heavy as 7 tons have been successfully turned out. The machine shop has under erection one 10-ton, the foundry, two 10-ton and one 5-ton, three-motion overhead electric travelling cranes, and the riveting shop, one 2-ton jib crane. The larger machines are all equipped with individual motor drive, while the smaller machines are driven in series by motors. There is no steam equipment used in the works.

The steel foundry now under erection contains one ½-ton electric arc furnace and one 1-ton Bessemer converter. The works expects to make first-grade cast steel for commercial purposes within a few months. As this is one of the few commercial steel foundries in China, the outlook is therefore quite bright. The metallurgical laboratory contains one complete set of micro-photographical apparatus for testing and research work on steel and iron cast in the foundry.

The accounting for labour and overhead is based on a modification of modern machine rate method to suit the plant conditions. As the output of the plant is quite constant, accurate burden charges can therefore be predetermined, and consequently manufacturing costs can be gauged more or less truly. The old practice was a guessing system by comparison.

The works specialises in the manufacture to order of special machinery for all industries, especially on mining, crushing, grinding, tile, clay, transmission, hoisting, and tank equipment. A sales office will soon be opened in Tientsin. The works is in charge of Mr. K. P. Hu, a graduate of the Massachusetts Institute of Technology. All sub-departments are under trained engineers. As the chief aim is to render service as a first-class machine shop, quality equal to that of the best foreign makes will be aimed at. Several large orders, including one for the Pacific Alkali Company's modern plant at Tangku, have recently been put in hand.

The various Refractories Associations are organising, next Tuesday, at the King's Head Hotel, Sheffield, a complimentary dinner and dance and presentation of addresses as a "send-off" to Mr J. Kent Smith, O.B.E., who is shortly leaving for the United States of America, and Mr. Percival W. Duckenfield, of Messrs. J. & J. Dyson, Limited, who is sailing for Rhodesia in the near future.

The Classification of Foundry Defects.*

By F. H. Hurren, A.I.C.

It is imperative in all foundries to make regular examinations of defective castings, and that these examinations should take place at least daily is apparent to all who are interested in foundry production. The examination usually has two objectives, the allocation of responsibility for making a defective casting, and the remedy.

At times both cause and remedy are obvious, sometimes they are obscure. In spite of all the knowledge available, and the many aids which modern research has brought into play, foundry work is not an exact science, and, unfortunately, never will be. The human element enters too largely. There is no broad and beaten path to the production of good castings, and to a certain extent foundry work still consists of trial and error. It is true there are many pitfalls that are known and can be avoided, but the way of production of good castings is rugged and ill-defined.

Importance of Defective Castings Overstressed.

Defective castings are not the only important item in foundry work; although they add to the cost of production, there are other equally vital factors to consider in an attempt to run a foundry on economic lines. The reduction of scrap may be allowed to overshadow other items which add far more to the ultimate cost; and, to a large extent, defective castings have been permitted to assume undue importance. This point was well brought out in a leading article of The Foundry Trade Journal of January 22, 1925.

Defective castings are wasted effort, but effort is often wasted in a greater degree in many other directions which are not readily apparent. Manpower must be utilised to the best advantage, and the mentality and physical capabilities of each man needs a special study. It is often said that a good workman should be able to tackle any job in the shop. This may be true, but most men seem to have a particular class of job in which they show up to better advantage. The problem is to find this particular class of job to suit each individual. This is more possible, of course, in a shop where the bulk of the output is repetition work.

Then there is the question of the installation of labour-saving devices. No article of machinery is fulfilling its proper function unless it is working to the limit of its capacity. It is futile to install expensive plant to save a few shillings a day if capital charges and cost of operation cost as many pounds. There are furnaces in operation which admittedly are much more economical in fuel consumption than other types of furnace doing similar work, yet the value of fuel saved is more than counterbalanced by the extra labour charges involved and the increased cost of upkeep. Works systems can be carried to such an extreme that the cost of the organisation may exceed the market value of the castings produced.

Effecting Reductions in Cost Price.

These are but a few remarks by the way, and are intended merely to emphasise the contention that although scrap castings are an item to be considered, one must not give prominence to this subject to the exclusion of everything else.

Where large quantities of a particular pattern have to be made, it is only possible to obtain the production required at a reasonable price by semi-skilled or unskilled labour from a moulding machine. As a general rule, the scrap made by skilled operatives is less than that made by so-called unskilled labour, but the margin of difference in cost is more than sufficient to compensate for the extra risk entailed. This is a point worthy of consideration by buyers, whose sole aim, apparently, is to purchase castings at the lowest possible price. Prices for raw material vary only within very narrow limits, and a reduction in the selling price of castings can only be met by a reduction in cost of production. This is arrived at by partial or complete machine moulding and the employment of semi-skilled labour, which may tend to an increase in defectives.

Two Main Categories.

One of the many dangers that beset the foundryman is to imagine that because certain castings are showing good results this state of affairs will continue indefinitely. A foundry had been making a cylinder casting as a repetition job rammed up from pattern plates on a jolt machine, and had made several thousand castings with good average results. Gradually, and at first almost imperceptibly, the percentage of wasters increased, until the scrap assumed proportions which called for close investigation. Every detail operation was overhauled, yet for a time only a small percentage of the castings were good. The trouble consisted almost invariably of a dirty patch in one of the bores. Eventually this was overcome, and for the remainder of the order the castings were exceptionally good. The remedy applied was quite a small one, and to the unthinking worker it might seem impossible that so insignificant a detail should have so marked an effect.

It may not be out of place to emphasise the great importance of attention to detail in foundry practice. No point is too small to be undeserving of attention, and it is only by rigid observation of detail that good castings are produced and a reduction effected in the number of wasters.

Foundry defectives come under two categories—defective castings which are discovered in the foundry and not sent out, and those which appear to be satisfactory when despatched but show faults during machining or when put into work.

In attempting to evolve a system of classification it appears to me that there are two distinct methods under which defectives may be grouped. One method is to classify under cause of defect, irrespective of the material cast; the other is to classify under the different types of metals cast and the defects which are peculiar to each type. It is proposed to deal briefly with both classifications, and hope that views will be expressed as to which is considered the better method.

Classification by Cause.

Let us take first the general classification by cause. Broadly speaking, this may be sub-divided into four main types:—(1) Defectives caused by faulty workmanship; (2) defectives caused by bad or unsuitable material; (3) defectives due to bad design; and (4) defectives caused by bad management or working conditions.

There are many instances where these divisions overlap, but in the majority of cases the cause of wasters comes under one of these heads. At the same time each of these sub-divisions is capable of further sub-division into innumerable minor classes, any one of which may give rise to considerable controversy.

Scrap from Bad Workmanship.

Consider the first sub-division, *i.e.*, defectives caused by bad workmanship. This is probably the most vital, and the one which causes the greatest acrimony and heart-burnings.

Bad workmanship may comprise lack of skill, lack of care, or, in extreme instances, what might be termed culpable negligence. Under this head there are blows, mis-runs, scabbed and dirty castings, cross-joints, misplaced cores or loose pieces, crushes, run outs, short pours, insufficient or inefficient feeding, bad shape due to soft ramming, castings cracked or damaged during knocking out of the boxes, and castings spoilt in fettling. These are the more common causes of scrap.

A "blow" may be caused by hard ramming, sand too damp generally or locally, lack of venting, vents in cores not connected, or chills not properly cleaned. Blowing may be of sufficient violence to eject molten metal from the mould, or imperceptible during casting but evidenced by a

* A Paper read before the London Branch of the Institute of British Foundrymen, Mr. V. C. Faulkner presiding.

small hole or series of holes on a machined surface. When molten metal is poured into a mould there is a very large volume of gas generated, which must escape quickly. This volume of gas naturally takes the easier path, and if the pores or vents of the sand are so small as to offer any resistance the gas will make its way out through the still liquid metal, with the consequence that the casting is scrap. Under whatever circumstances a blow takes place, it is the author's opinion that the fault can only lie with the workman or workmen concerned.

Run-outs and short pours are obvious faults of the operative, and there is really no excuse for either.

Cause of Mis-runs.

Mis-runs may be caused by slow pouring, by runners being cut too small or of bad shape, or by cold metal. Some men habitually dribble metal into the mould, and make no attempt to keep the runner-box full. This can only increase the risk of mis-runs; and of those castings which have run up, many have to be rejected on account of the presence of slag and dirt.

The size and shape of runners require considerable care and thought. A runner should be so proportioned that every part of it can be kept filled with metal during casting. The area should be greatest at the top, and gradually reduced down to the point where it joins the casting. It is obvious that if the area at the junction with the casting is greater than the area of the down-gate, there is a liability of sand being drawn by suction from the in-gate into the casting. Yet an examination of runners will show this to be quite a common fault. The classification of this defect is rather indefinite; on a pattern plate it is obviously a fault of the management, on a loose pattern it is partly the fault of the workman, but the management must share the responsibility.

Mis-runs due to cold metal may be classed as faults of the workman. Where one shank of metal will cast a number of boxes the danger of mis-runs in the last boxes cast is apparent, yet workmen seem to have a rooted objection to carry any metal back to the furnace, and will pour a mould when the metal is obviously too cold.

Scabbed and Dirty Castings.

Scabbed and dirty castings open up a wide field of investigation. Dirty castings may be caused by careless pouring, not properly skimming the metal in the shank or crucible and allowing slag to enter the mould, or by failing thoroughly to blow out the mould before closing. One of the most prolific causes of dirty castings, especially on repetition work, is the presence of loose edges of sand in the runners. The down-gate is often cut with a tube, and this invariably leaves ragged edges of sand exposed. Unless the down-gate is tucked round with the fingers after cutting, and then blown out, the first rush of metal carries away the loose sand into the mould. When a mould or core is blacked, it is very necessary to ensure that the blacking is not loose, otherwise it is liable to wash in front of the metal and show up in dirty streaks or patches on the casting.

Scabs may be due to uneven ramming, parts of the mould being much harder than others, to insufficient venting, and in a dry sand mould to incomplete drying. At times a scab is formed through using an unsuitable sand mixture, such as using ground sand where an open sand is required. It happens very rarely that a scabbed casting can be used, as the sand displaced at the scab is generally distributed about the casting.

Cross-joints can only be ascribed to the operative. In machine moulding, where the boxes are closed by means of loose pins, it may be that the pins are worn, and not a tight fit in the bushes. On the other hand, it is possible that the top part might be shifted slightly after closing, especially during weighting the moulds.

A crush is always to be avoided; unfortunately the moulder usually guards against this contingency by undue rubbing of the joints and cores. This results in a lot of unsightly fins and flash, and increases the cost of fettling. If possible one should strike the happy mean. Misplaced cores and loose pieces are generally the result of lack of attention to detail, and are clearly faults of the workman.

The feeding of castings requires both skill and patience. Good castings can be spoiled by the feeding rod being pushed down into the side of the mould and bringing sand back into the casting. It sometimes happens, too, that by careless feeding metal is fed away from rather than into the casting. Castings damaged during knocking out or in the fettling processes can only be set down to carelessness.

Defectives Due to Bad or Unsatisfactory Material.

It is a well-known fact that a workman will almost invariably blame the metal for a scrap casting. At times there is justification for this. Small pinholes on machined surfaces are usually due to overheated or partially oxidised metal. This is especially noticeable on castings in aluminium, gun-metal, and phosphor bronze. With any high copper alloy oxidation is evidenced by a brilliant red tinge on the surface of the casting, and red streaks in a fracture of the metal. These red streaks are to be observed when breaking off the runners, and a thorough overhaul of the melting practice is indicated. The failure of the aluminium castings on pressure test is due usually to casting at too high or too low a temperature. A high casting temperature is the more common fault.

One other trouble with aluminium alloys is segregation. The ordinary type of aluminium alloy is generally made by melting pure aluminium, adding a copper-aluminium hardener, and finally, just before casting, the necessary quantity of zinc. Unless the mass of metal is thoroughly well stirred, and sufficient time allowed before tapping for the zinc to be absorbed, some of the zinc will settle at the bottom of the bath. In consequence, if several moulds are poured from the one melt it is possible that the first castings will be low in zinc, and the last cast very high in zinc. The latter may show characteristic needle-like crystals on the bottom side. There are numerous other material troubles causing defective castings, some of which will be referred to later on.

Defectives Due to Bad Design.

Everyone connected with foundry work has been expected, at some time or other, to do what has been practically impossible. Modern engineering practice demands more and more from the foundry, and designers will not always realise there is a limit. This is especially so in cylinder work. Cylinders are designed with narrow water-jackets, necessitating very thin and fragile cores. These thin cores unduly retain heat, and militate against sound, pressure-resisting metal. Cores are made to finish at a feather edge, and it has been definitely established that a feather edge causes a tendency to blow. The same may be said of joints in cores, and it should be realised that every joint in the cores increases the risk of a defective casting. Usually where reasonable representation has been made modifications have been allowed, but often the hands of the designer are tied by the demands of the user.

There are many instances which could be cited where the design has been against the production of good castings, but this matter has been dealt with at length by many, and will, no doubt, maintain until the millennium.

Defectives Caused by Bad Management.

Without going too deeply into the matter there are a few points which may be worth consideration. Under the head of management is included anyone in a position of authority. In the first place, no man can do good work if he is continually in a state of fear that he will be discharged on the slightest provocation. The opinions of a workman should be allowed expression respecting his work, and he should be encouraged to think for himself. It is thought that more scrap castings are made by a workman not thinking than the reverse. Then, again, a frank discussion with the men concerned in a scrap casting will often result in an improvement in the work performed.

Scrap castings caused through lack of adequate tools or floor space, or the provision of unsuitable

tackle, is a matter for the management to deal with. There are pattern plates which are worked day after day with one casting in four cross-jointed, when either stopping-off that casting in each mould or pouring and returning to the scrap heap is wasted effort.

Trouble sometimes results when the moulds put down are beyond the melting capacity of the furnaces. This is particularly so where the moulds are skin dried; on standing, there is a risk of steam condensing on the mould face and liability to blow.

As to working conditions much might be said, but it is not within the scope of this Paper. The lay-out of a foundry is often very haphazard, but this may be due to the fact that the business has expanded beyond its original conception, and not to wilful neglect or want of care.

Alternative System of Classification.

The first system described is most applicable to foundries dealing with all classes of castings, but as a number of foundries now specialise on one type of material the latter system is worthy of consideration.

In a Paper of this nature one cannot deal with every known metal, so it is intended to confine attention to the common metals.

Aluminium.

Several of the more important defects from which aluminium castings suffer, such as pinholes, porosity, and segregation, have been mentioned. Cracked castings are a rather common defect, owing to the weakness of aluminium alloys at high temperatures. Much of this trouble can be overcome by the use, where possible, of green-sand cores; failing that, rapidity of action is necessary in knocking out the moulds and releasing the cores and core-grids. The usual aluminium-copper-zinc alloys are very prone to crack, and where this trouble is extremely difficult to overcome it might be policy to alter the composition of the alloy. Two mixtures with which the author has had personal experience, an aluminium-silicon alloy and an aluminium-copper-silicon alloy, give excellent results in thin castings of intricate shape; their freedom from cracking is remarkable.

In running aluminium castings of unequal thicknesses better results are obtained, and the thicker sections more solid, by running through a thin section into a thick section than by the reverse method.

Casting temperature is an item of importance to prevent mis-runs, porosity, and general unsoundness. Owing to the comparatively low melting temperature of aluminium alloys it is practically impossible to judge temperatures by appearance. Holding the back of the hand over the pot is purely an empirical method, and very prone to error. Pyrometers suitable for direct immersion are relatively cheap, and although the use of a pyrometer will not ensure good castings it will save an appreciable amount of scrap.

Thin, flat sections cast horizontally are liable to mis-run, and although it may sound contradictory this tendency can be often cured by slower pouring. By filling up a mould very quickly one does not give the air in the mould much chance to escape, and as aluminium sets almost immediately there is always a risk of an air-lock. Reducing the rate at which the mould is filled largely discounts the risk.

Gun-metal and Phosphor Bronze.

In addition to the usual foundry troubles one of the most potent causes of scrap is oxidised metal. The melting of copper alloys demands a certain amount of skill and knowledge, and good material is easily converted into bad material by careless or incorrect melting. Casting temperature is worthy of consideration. In casting small cored bushes a high-temperature metal gives rise to hot cracks and a low temperature to cold shuts. Although the direction and extent of these cracks are similar, they are distinguishable by examination of a section through the crack. A cold shut is dull and smooth, a crack due to high temperature is rough and usually tinged with colour.

Phosphor bronze is liable to sweating if cast too hot, grey beads of metal oozing out on the surface. Special attention to the facing sand is necessary, as this metal has a property of eating into the face of the mould or core, giving a rough, unsightly casting.

Cast Iron.

There are two distinct classes of work made in cast iron, namely, dry sand and green sand. Cylinders are typical of the former, and most small cast-iron parts of the latter. There is a great danger of defectives with dry-sand moulds unless they are thoroughly dry. An incompletely dried mould is worse than a green-sand mould, particularly when cored up whilst warm, as steam is always liable to strike back on the face of the mould and cause a blow. Dry-sand moulds are much less liable to scabbing and blowing than are green-sand moulds, but there is just as much need for carful venting in one as in the other.

Where dry-sand moulds are wet blacked before drying it is always advisable to make sure the blacking is firm after drying. One of our most puzzling forms of defectives was caused by loose blacking washing off during casting.

Porosity is another cause for rejection, especially in cylinder work. Porosity may be due to a blow, a draw, or to unsuitable metal. A draw may be the effect of incorrect casting temperature, runners badly placed, lack of feeding, or the need of chills. The author dislikes using chills in cast-iron work if it is at all possible to avoid doing so, as in curing one trouble they often introduce others. External chills present little or no difficulty, but internal chills require considerable thought and care. In cylinder work one is not always able to use single-piece chills, owing to the difficulty or impossibility of getting them out again. A compromise has to be effected in making a portion or the whole of certain cores in iron filings or shot. If these are mixed into a thick paste with a core binder, they can be removed from the casting as easily as the core sand. A draw may be due to the use of an open-grain iron, though this is not so likely with cylinders of comparatively small dimensions.

Malleable Iron.

Defectives in this material may be due to an infinitive variety of causes. Insufficiently annealed castings are among the worst features of malleable iron, as the outer surface is generally soft, but the bulk of the section still in the hard state. If only the surface of the casting is machined, it is possible for insufficiently annealed castings to get into service without detection. Time saved on the period of annealing is not economy; the author is becoming more and more convinced that there is no short cut to annealing, but that success depends on time and temperature.

Over-annealing is not, it is thought, so serious as under-annealing. Speaking generally, the chief result of over-annealing is a reduction of the tensile strength, and most malleable castings are designed with a generous margin of safety.

Brittleness is a very undesirable factor. A casting may appear soft, easily machinable, and yet have no ductility. Experience has shown that this state is associated with a high silicon or a high carbon content. The former is usually evidenced by a dark fracture similar to black heart, whereas the latter is brighter and inclined to glitter. In a malleable casting of average section, correctly annealed, the total carbon content should not be higher than 1.5 per cent. With soft but brittle castings the total carbon content will be over 2 per cent. This may be the result of a shortened annealing period, but is more often caused by using a pig originally high in carbon. To obtain the best results the total carbon in the hard casting should be about 3 per cent. Much of the pig now on the market has a total carbon from 3.2 to 3.6 per cent.

Contraction cracks or sears are faults confined almost exclusively to malleable iron. There is great difficulty in overcoming this trouble, and different methods of gating and feeding must be tried out.

Distortion adds considerably to the expense of producing good castings. This will never be entirely eliminated, but it may be mitigated to some extent by careful attention to packing in the ovens and by the provision of specially shaped

packings in unsupported parts of certain castings. Distorted castings require setting before use, and in this connection there is diversity of practice. Some castings are set cold, but it must be remembered that to obtain a permanent set the metal must be stressed beyond its elastic limit, and, in consequence, considerably weakened. On the other hand, hot setting may result in the metal partially reverting to its preannealed state during cooling down again, and the casting becomes unsuitably hard.

One other cause of scrap that might be mentioned is cracking during the annealing process. A casting may be perfectly sound when packed in the oven, yet come out cracked, or, in extreme cases, in several pieces. There are two main remedies for this, both of which may be necessary. One is to remove the casting from the sand as soon as it is set, and transfer it, whilst still red hot, to a muffle furnace. The temperature of the muffle can be let down gradually, so as to ensure the castings a slow cooling. The other, and probably more important remedy, is to bring the annealing furnace up to heat in easy stages, so that the castings are not subjected to a sudden rise in temperature.

It should not be thought that although the causes of defectives are legion, they are so manifold as to preclude the possibility of making good castings. Many foundries produce wonderful results; but it is necessary to impress on everyone the wisdom of examining the scrap pile regularly and consistently. A retentive mind will derive much profit from the failures.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Desulphurisation of Cast Iron.

To the Editor of the Foundry Trade Journal.

Sir,—I am surprised to see in your issue of the 19th inst. an article by Mr. G. C. Castle, who incidentally has written to the "Irish Builder and Engineer" a letter dealing with the same matter—the desulphurisation of cast iron. In both contributions he has compared the "Walter" process with one which he states has been invented by an engineer, apparently also a German, named C. Rein. He has, moreover, suggested that the process assigned to Herr C. Rein is vastly superior.

The truth of the matter, however, seems to be as follows:—

Walter undoubtedly originated the idea of desulphurising with fused soda ash, to which he, however, added relatively small amounts of alkaline earths, probably with an idea of slightly thickening the abnormally fluid slag. In course of time it was found that the best way of carrying out the reaction is in a forehearth, in place of carrying it out in small quantities in the ladle.

When Dr. Moldenke was in Germany he carefully watched the method, and gave me the following details:—

That the plant he saw in operation comprised:

(1) A cupola fitted with the syphon tapping arrangements.

(2) A forehearth, with a door, directly opposite the taphole of the cupola, which is used for the double purpose of introducing the soda-ash and for allowing access to the upper taphole in event of the principal or middle hole "bunging-up," and to the lower one, when it is necessary to empty the cupola. The forehearth has a slag-notch through which the basic slag runs off, and the purified cast iron is tapped from a taphole situated in the bottom of the forehearth.

(3) The apparatus he saw in action also had a special arrangement for collecting the cupola slag, which consisted of a slag chamber, into which the ordinary cupola slag-notch discharged, but the chamber itself was capable of sealing off from the outside air, and thus attained the same pressure as obtained inside the cupola—the result being that the slag ran out regularly and quietly, and collected in a slag-ball in which a hook was placed, and the whole "ball" was removed periodically. A refinement, no doubt, but one that could not affect the problem of desulphurisation one way or another.

Then Mr. Castle describes an arrangement for heating the forehearth. Neither Rein nor Walter can lay any claim to originality there, as many cupolas have been so fitted for a considerable time. So it seems that after all there is amazingly little difference between what Dr. Moldenke described, when in Dublin, and the process Mr. Castle has assigned to Herr Rein.

I assume, however, that his statement that "By treating a ladle of molten iron—after the slag has been removed from the surface—with an alkaline earth an immediate strong expulsion of gases will result, and subsequent analysis will show that the sulphur content has been considerably reduced," is made in error, as it has been proved by universal experience that the active agent in the "Walter" mixture is anhydrous sodium carbonate.

That the action is a quiet one is quite certain, and that no considerable evolution of gas takes place after the first approximate, half a minute after adding the sodium carbonate, and this is, no doubt, partly due to dampness in the sodium carbonate itself, for it must be remembered that washing soda crystallises with 10 molecules of water and the anhydrous salt is liable to be affected by damp. There also would be an evolution of CO_2, but it is extremely doubtful if there is any actual removal of gases which were previously in solution in the cast iron. Nothing of the sort has been proved, and the writer can see no reason for expecting it to take place.

What probably does occur is as follows:—

$$Na_2CO_3 + FeS = Na_2S + FeO + CO_2$$

The FeO most likely goes into the slag, and the CO_2 causes that motion on the surface, which is, no doubt, due to a quiet evolution of gas.

The whole question, therefore, seems to boil down to putting a Na_2CO_3 slag on a clean surface of cast iron, and using suitable means for guaranteeing the separation of metal from basic slag, which means on the large scale are afforded:—(*a*) By forehearth arranged as described; (*b*) by using a bottom pouring ladle; and (*c*) and possibly the best way, by using a tipping ladle as described as being in operation at the Griffin Wheel Company's works.

Whether the process is labelled Walter or Rein is immaterial, for desulphurisation by Na_2Co_3 should be available to anyone who likes to use it. Surely no one can protect such procedure?—Yours, etc.,

H. Grattan, A.R.S.M.

45, Synge Street, Dublin.
March 21, 1925.

The Refractories' Association.

The members of the Refractories Association held their annual meeting at Sheffield recently. The retiring president, Mr. Frank Russell, reviewed the proceedings during the last year, which has been one of the most successful since the Association was formed, and the secretary's and treasurer's reports were confirmed. Mr. Frank J. Boam, of Leicester and King's Lynn, was elected president for the present year, and the following officers were also elected:—Vice-presidents: Mr. J. G. Williams, John Williams Birmingham Sand, Limited; Mr. Charles Jones, Gwereyllt Silica Brick Company, Limited; Mr. C. H. Oakes, James Oakes & Company (Riddings Collieries), Limited; Mr. F. H. Brooke, Oughtybridge Silica Brick Company, Limited; Mr. J. Holland, Pickford, Holland & Company, Limited; Mr. W. F. Pirrit, Caldwell Sand Company; Mr. H. Hinchliffe, John Hinchliffe & Company; Mr. H. Winterton, Wm. Cumming & Company. Council: Mr. F. G. Foster, the Yorkshire Amalgamated Products Company, Limited; Mr. A. H. Middleton, the Consett Iron Company, Limited; Mr. T. Scarson, Jas. Oakes & Company (Riddings Collieries), Limited; Mr. A. Loman, J. & J. Dyson, Limited; Mr. F. Coultas, the Armitage Works Company, Limited; Mr. F. M. Fisher, the Bramcote Sand Company. Hon. treasurer: Mr. C. Jones, J. Grayson Lowood & Company, Limited. Hon. secretary: Mr. W. J. Rees.

Lecturing before the Birmingham Metallurgical Society, on March 19, on "Aluminium," Mr. G. B. Brook, chief chemist of the British Aluminium Company, after tracing the development of aluminium from the productive point of view, gave a general review of the methods of manufacture associated with his company at Kinlochleven.

The Making of a Crane Barrel.*

By E. Flower.

A crane barrel is one of those simple castings which very often causes the foundryman a great deal of trouble. As an example, one weighing approximately 25 cwts., with one internal and one external boss, will be cited.

Now, the usual method of making a casting of the type shown in Fig. 1, if it is to be made in sand, is to have a full-length pattern, made in halves. This is moulded on its flat, in a two-parted box, and when dried, cored up and closed is turned up and cast on its end. This is a very dangerous method, because when the mould is turned up on its end, after finally closing, the moulder is at the mercy of all kinds of uncontrolled factors, such as a careless crane driver or the movement of the core, if it is not studded firmly to the sides of the mould. Now, to obviate all such risks, it is proposed that this mould should be rammed on its end, in the same position in which it will be cast. The first essential is a suitable set of moulding boxes, and it should be clearly understood that this is only a commercial proposition in the shop where this class of casting is likely to become a repetition job.

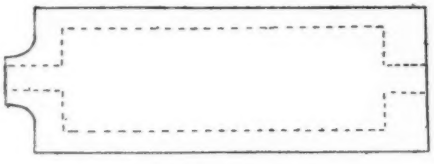


Fig. 1.

In determining the style of boxes to be used it is left to the individual choice as to whether they are to be round or square, but assuming square boxes, they must be in series of not more than 12 in. deep.

The primary saving by this method is in the pattern making, for instead of a full-length pattern, a small section only is required, something like 18 in. to 2 ft. in length, with one boss for the external end attached.

Referring to Fig. 2 and before proceeding further it has to be determined how the core is to be held down—is it better to hold it down from the top or from the bottom? If it is held down from the top by means of a bar and cramps or weights, this tackle must be released at the same identical moment—that is, when the iron has solidified sufficiently to retain the core in its desired position, and before the barrel on which the core is struck has time to expand with the heat of the casting. If this tackle is taken off too early the core will swim, giving more metal at the bottom than is required and less at the top, whilst if it is left too long the core is likely to buckle, owing to the expansion of the core barrel being retarded. Seeing that it is a matter of guesswork as to when the proper time has arrived to release the tackle at the top, it is better to leave the top of the core barrel free and fasten it down from the bottom, then the barrel will be able to expand freely. The second requirement is therefore, on account of all the boxes being open both top and bottom, a bottom plate, which is designed as is shown in Figs. 3 and 4.

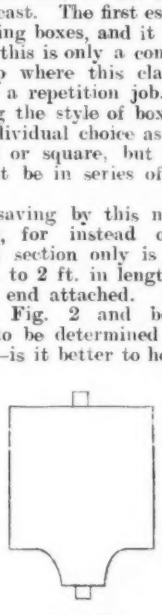


Fig. 2.

This plate is cast with a boss underneath, through which a $\frac{7}{8}$-in. hole is bored. A round hole is also bored right through the middle of the plate and boss, sufficiently large to take what is thought likely to be the largest bored casting ever to be made. This hole is counter-bored on the inside to take a series of bushes, as shown in Fig. 5, which will all be bored differently to suit castings of different bores. This is mainly determined by the diameter of the core bar. The bore of the casting under consideration is $5\frac{1}{8}$ in., but the diameter of the core bar to be used is 4 in., so a bush bored out to $4\frac{1}{4}$ in. should be used. This will give a $\frac{1}{8}$-in. clearance on each side. This bush is placed in position and is level with the inside of the plate.

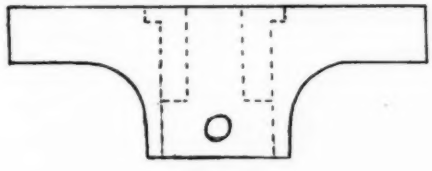


Fig. 3.

The next thing to be decided is the number of boxes it will take, on the basis of them all being 12 in. deep. Then the position of the finished mould in respect to the bottom plate, after allowing for a level joint at the top, must be considered. The mould having to be 6 ft. $6\frac{5}{8}$ in. over all, it will take six open boxes, leaving $1\frac{1}{2}$ in. of the body, and the boss ($5\frac{1}{8}$ in.) to be sunk in the bottom part. To be certain that the pattern is at the correct distance from the bottom plate, a loam cake, previously made, 2 in. thick, with a $5\frac{1}{8}$-in. hole in the centre, is bedded on pieces of packing $3\frac{3}{8}$ in. on the bottom plate. When this is correctly placed in position and rammed round with sand the pattern is placed on the loam cake, being set by the core print on the pattern, fitting in the hole in the loam cake, and from here it is a straight ram-up, excepting when the moulder is ramming up the top part. The $5\frac{1}{8}$-in. round core print is carried right through. This stage is shown in Fig. 6.

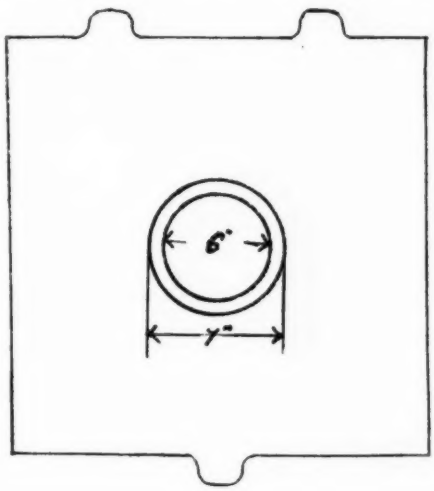


Fig. 4.

After finishing and blacking, the mould is put into the stove, and during drying, the core is prepared. It will be remembered the core bar was 4 in. diameter and of suitable length, and drilled all the way up alternately with $\frac{1}{2}$-in. holes at

* A part of a Paper read before the Burnley Section of the Institute of British Foundrymen, Mr. E. Barnes presiding.

about 6-in. centres. It is also screwed at the bottom end, about 2 in. of the way up, and at 3 in. from the bottom there is a $\frac{7}{8}$-in. hole drilled right through.

In reverting back to Fig. 6 it will be seen that from the top of the hole in the boss of the plate to the first face of the casting is $8\frac{1}{2}$ in. This measurement is given to the core maker, who sets his core bar to his core board accordingly. The usual method of making this kind of core is to

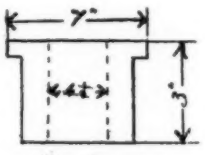


Fig. 5.

fasten cast-iron rings on the core bar, which is not only a long and unnecessary job, but makes the dressing of these castings a very expensive item, as all these plates have to be broken and drawn through the small bore of the casting. Instead of using plates it is preferable to fasten a few cast-iron prods in the vent holes already drilled in the core bar, Fig. 7, round which the moulder starts to wind straw ropes, over every course of which soft clay is rubbed. The core is then struck up to within the thickness of the

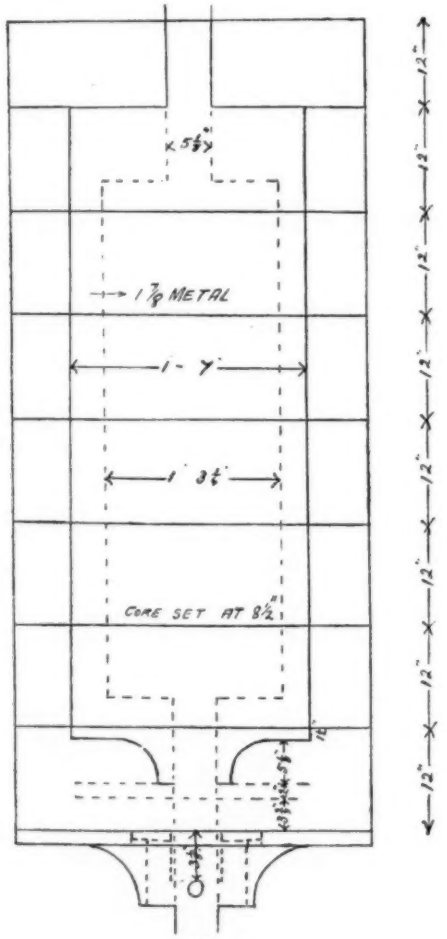


Fig. 6.

bore, and then stoved, after which thin cotton tope is wrapped round that part of the core bar which forms the bore. The whole is struck and slipped up to a finish.

In closing the mould, two weights are levelled on the floor on which the bottom part is placed. The bottom part of the core barrel is rammed with sand to prevent iron getting in the barrel, and the core lowered into position until the hole in the core bar comes opposite the hole in the boss on the bottom plate, when a suitable bolt is pushed right through, on which the core will stand upright; the six middle parts are then placed in position over the core, either singly or all together, according to the adaptability of the shop. Care, however, must be taken in placing the top part in position, as the core going right through the top part and fitting in the print at the bottom

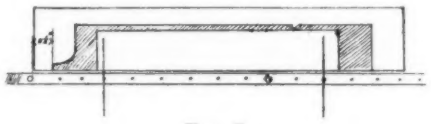


Fig. 7.

is the only means taken to keep the core central, and only $\frac{1}{16}$ in. in variation of thickness from top to bottom has been allowed. When all is assembled, cottered, or bolted up, the whole is lifted up bodily in the crane, and soft loam is stuffed between the core barrel and the inside of the bottom boss. Then a nut (Fig. 8) is screwed to the bottom of the barrel. There is no fear of over-tightening as it is pulling iron against iron. The whole is then lowered into a pit, bushed up, and is ready for casting.

The author has found this method so successful at his works that, after constantly making barrels from this method for two years, he has yet to make his first waster.

In conclusion the author expressed his best thanks to the Vaughan Crane Company, Limited, of Manchester, for the facilities offered him in preparing this Paper, and especially to Mr. W. P. Corden, their branch manager.

DISCUSSION.

Mr. J. Pell said the paper was of a specialised character dealing with a particular class of work and there were several points of interest to the members on which additional information might have been given, such as the method of running,

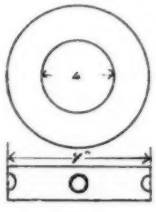


Fig. 8.

the thickness of the metal and details of riser heads. He observed that in the base plate for the crane barrel there was a bush bored out to $4\frac{1}{4}$ in. and apparently only $\frac{1}{16}$-in. was allowed for clearance. Mr. Flower put into that $4\frac{1}{4}$-in. hole a 4-in. core bar. It was not stated whether the bottom plate was in one part or two parts. In order to be accurate, such a casting must be centred up at the bottom. These points attracted his attention as a practical moulder. If he were doing the job he would have run it from the top, as there was a considerable pressure of metal on the bottom part of the mould.

The method adopted by the author in making the core for the crane barrel was new to him; it did away with the necessity for a quantity of plate making, and seemed to be a very good scheme. At the same time it was his opinion that if prods were put in all the holes the free venting of the core would be stopped.

Mr. Flower said there was a difference of opinion amongst foundrymen as to the best method of running a crane barrel. This job was, in fact, run at the bottom, a method which he favoured.

In the first instance the plate was bored out to suit the largest bored casting that would have to be made, and the bushes were then made to suit the individual castings. In the present case the bush was bored out to $4\frac{1}{4}$ in., which allowed not $\frac{1}{16}$-in. but $\frac{1}{8}$-in. side clearance for the core barrel. No clearance was allowed for the core print because in the loamcake a $5\frac{1}{8}$-in. hole was bored, which was carried right to the bottom of the plate.

When lowering in the core the prints fitted exactly into the hole in the loamcake at the bottom.

The bottom was not in parts at all. The core fitted into the print in the loamcake and rested upon the bolt which passed through the hole in the boss on the bottom plate. The core fitted the hole, and it obviated any necessity for using studs of any description. This method was applicable to any job that required testing by pressure.

Mr. Smith: Do you never pin the core at all?

Mr. Flower replied that it always stood straight after being dealt with in that way. It would stand any way they liked.

One prod was put in near the end of the core; another at the other end; then two in the middle. He was speaking of a core 8 ft. in length. The diameter of the mould was 23 in. and they allowed 1⅞-in. for the iron. That left practically 19¾ in. The bottom would be level when they placed the packing underneath the loamcake.

The core did not rest on the loamcake; it rested on the bolt; but it was governed by the 2 in. of the loamcake and the 3⅜-in. of the packing. It did not move to any material extent. If it did it would break the top of the loamcake.

Mr. Jackson inquired as to what else there was to hold that core definitely perpendicular, other than the bar bolted to it.

Mr. Flower said there was nothing at all except the print in which it is set. The print goes right through the loam ring to the bottom of the inside of the mould. One must bring the print right over the centre of that hole in the loamcake.

These crane barrels were machined—every inch of them—top, bottom and sides. They were also grooved from top to bottom.

Mr. Pell said in the Burnley district there was a good deal of work of a similar character, a calender bowl with a boss at either end outside. They had to be perfect, that is, not a trace of defect, and some, which were afterwards coated with copper, had to be polished up like silk. The method described by Mr. Flower of running at the bottom had been tried and always resulted in failure. Experience seemed to show that the best method was to run from the top.

Mr. Flower said visitors to the foundry were often astounded when they had seen the castings and were told the way they had been run. It was said, "You should run them from the top. It is the best way." That might be, but when one had been using this method for two years without making any wasters there was no inclination to change. Perhaps they had been very fortunate, but until they were unfortunate they would continue to run at the bottom. He added that he was glad to have had the opportunity of bringing this method before the members of the Burnley Section because he knew the class of work made in the district and he thought the system he had described was applicable to other jobs besides crane barrels.

Mr. J. Hogg said when he could he always liked to run at the top. From the metallurgical point of view, in a moulding proposition, it appeared to him the better method. He had run moulds, 15 to 17 ft. deep by 20 ft. in length, many times without any trouble. At the same time he knew that in districts like Birmingham and South Wales the practice was to run rollers from the bottom. He had seen castings of upwards of 30 tons run at the bottom with spinning gates; it was almost impossible to run those from the top. As Mr. Pell had remarked it was a matter of opinion, and at all events Mr. Flower personally had been remarkably successful.

Mr. Flower said he might appear to be inconsistent if he said he believed in running at the top, but, in fact, that was the better method in some cases. It all depended on the cavity into which the iron was being run. A few years ago in a shop in the Midlands he took part in the making of pipes which were about ⅜-in. thick and 12 to 16 ft. long. Those were cast on end and run from the top. There was a great difference between a pipe ⅜-in. thick and a barrel 2 in. thick. The iron fell in different ways. In the one case, the 2 in., it fell with a splash on to the bottom of the mould; in the other case it did not fall straight to the bottom, but came down the sides, like rain, and when it reached the bottom it did not exert as much pressure. As Mr. Hogg had said, there was a metallurgical point of view to be considered.

Mr. Pell asked what was the temperature at which Mr. Flower cast. Some people advocated casting white hot, in order to get a clean casting.

Mr. Flower replied that this was a point on which foundrymen differed. His own practice in this case was to cast at ordinary temperature.

A vote of thanks to the lecturer was proposed by Mr. Jackson, seconded by Mr. Vernon, and carried unanimously.

Iron Cementing Compositions.

Cracks in Wrought-iron Articles.

To repair fine cracks in wrought-iron articles a very useful cement is made by carefully melting sulphur and adding to the thin semi-viscid liquid finely sieved graphite powder, taking care that the mixture persists in the liquid condition. It is then allowed slowly to cool, with constant stirring. The crack in the wrought iron is then covered with a suitable amount of the solid cement, which is then melted *in situ* with a hot iron. Alloys of antimony, lead, and bismuth can also be used for cementing castings, a suitable cement consisting of 2 parts lead, 2 parts antimony, and 1 part bismuth; or of 8 parts lead, 3 parts antimony, and 1 part bismuth.

Linseed Oil and Wax Compositions.

Very good iron cements are also included in the linseed-oil type of cement. For example, an efficient adhesive for cast iron can be made by mixing 27 parts of finely ground graphite with 13 parts of finely ground chalk and 36 parts of finely ground heavy spar; 30 parts of linsed oil varnish are added to this mixture, and the whole well stirred into a plastic paste. As an example of a lead-free metal cement may be cited the mixture of 30 parts of graphite, 40 parts of ground heavy spar, 15 parts of slaked lime, and 15 parts of boiled linsed oil. The plasticity of this cement is increased by treating the mass to violent percussion with a mallet. As an example of a so-called "diamond cement" for metals, the following may be given:—To a mixture of 100 parts of graphite, 30 parts of litharge, and 20 parts of precipitated chalk is added 10 parts of powdered slaked lime. The whole mass is well rubbed up in a mortar, and then 40 parts of linseed-oil varnish is stirred in. This cement should be warmed up before use. Another cement of general applicability for metallic articles is made by mixing 10 parts of white lead with 5 parts of red lead, 5 parts of clay, 190 parts of powdered pyrolusite, and 25 parts of graphite. The whole mixture is intimately mixed in a mortar and 35 parts of linseed-oil varnish well stirred in.

A metal cement with a wax basis, particularly adapted for the repairing of cast-iron articles, is made by melting 15 parts of yellow wax and gradually stirring in 50 parts of fine iron filings. Then 2 parts of French chalk and 4 parts of pine rosin are added, and the whole mass heated for 30 to 40 minutes. To obtain the best results with this cement, when using it for the purpose of smoothing-over holes and pores, it is advisable to employ a heated flat iron. Both in hardness and in colour, this cement closely resembles cast iron itself.

The Well-known Rusting Cement.

The last cement to be mentioned is the well-known rusting cement ("Rostkitt"), which has found the widest application of all iron cements. This consists of 85 parts of iron filings, 10 parts of flowers of sulphur, and 5 parts of salammoniac stirred up with a little water to form a paste. After the surface to be treated has been well cleaned with a wire brush the cement is applied, and after a day or two becomes stone-hard. The action of this particular cement is due to the oxidation of the iron filings. The addition to the mass of ammonia or acids accelerates the setting of this cement.—"Chemical Trade Journal and Chemical Engineer" translation.

The Selling of Castings.—X.

By Voyageur.

One must now turn from the broad principles of advertising castings to a consideration of two practical matters of the highest importance—where to advertise them and why. A certain sum will, if the recommendations in a previous article have been carried out, have been set aside for advertising as part of the general sales expenditure. The publicity or advertising manager will have to ask himself the following questions before proceeding to spend the money granted to him:—

(*a*) Shall the castings be advertised in the daily papers?

(*b*) In general periodicals?

(*c*) In the trade or technical papers?

(*d*) In directories, diaries, year books, etc.?

(*e*) By means of posters?

(*f*) How much space shall the advertisements occupy?

(*g*) With what frequency shall they appear?

(*h*) What is the best form of campaign?

(*i*) Can any method of tracing results directly to advertising be evolved?

There is no golden rule that will help the sales manager in deciding what proportion of the general sales allotment shall be devoted to advertising solely. A great deal depends on the character of the castings themselves. These may be better adapted to selling by dealers or salesmen than by advertisement in certain media, or *vice versâ*. The condition of trade is another important factor. Sometimes there is a prejudice on the part of buyers that only persistent advertising will remove, which would mean a heavier advertising expenditure than usual. All these points must be considered before definitely deciding on the gross sum to be expended on advertising.

The manufacturer of castings will seldom, unless these castings are particularly valuable in domestic life or capable of service to the man in the street, find it advisable or profitable to advertise in the daily papers. Big circulations are, of course, a tempting bribe, but although out of the million readers of a big London daily 1,000 may be interested directly in castings of your sort, it does not follow that your advertisement will, even if they see it, prove effective. Buying mood is a thing that has to be taken into account. Daily papers are read in moments of leisure, and most men dislike the intrusion of business into their leisure hours. Even if the 1,000 see and read the advertisement—which is hypothetical—the point is that the same people could have been reached just as quickly and effectively in a far cheaper way. The price of space in a daily paper is enormous because it is based on an enormous circulation. To aim at a thousand buyers of castings by means of a daily paper is as wasteful as firing a million shells in order to kill a thousand men. For most founders, then, the daily Press is not economical.

Advertising castings in general periodicals, such as weekly chatty papers or the illustrated monthly magazines, is uneconomical for precisely the same reasons. Most of the large circulations of these papers is waste so far as the founder is concerned.

The really efficient home for the casting advertisement is the technical Press, consisting of weekly, fortnightly, monthly, and quarterly papers. The reasons for this, though fairly obvious, will lose no force by being enumerated. The buyer who wishes to buy castings in a certain material, or who wishes to change his source of supply, goes for the names of founders to the engineering or trade papers, not to the great dailies, nor to the monthly magazines. Why is this? It is because for years the editorial pages of the technical Press have enabled him to keep in contact with every phase of engineering progress in which he is interested, and have therefore led him to look upon them as trustworthy sources of information, and because these papers are, when all is said and done, the most likely places in which to find the names he wants.

The advantage of technical and trade journals is that they offer to the advertiser a picked circulation, and this is just what he wants. Only engineers or folk interested in engineering read engineering journals. Again, the confinement of their circulation to a particular section of the community means that the circulation will not be extraordinarily large, and the space rates, which are based on circulation, will be within the reach of the ordinary founder. Obviously, then, the technical and trade papers are the cheapest and most efficient medium for the advertising of castings, and the greater portion of the sum set aside for advertising should be spent in advertising in that section of the technical and trade Press most suited to the class of casting manufactured.

Turning now to directories, the writer is of the opinion that advertising in these is very serviceable to the founder who has a speciality of limited application. A specialised directory is usually resorted to when searching for manufacturers of castings for, say, pianoforte frames, aluminium tennis rackets, die castings, and the like.

As for posters, the same argument might be used as with daily Press advertising. The public reached is not sufficiently specialised. Furthermore, it is impossible to check the results of this form of advertising. It seems to the writer highly improbable that a skilled buyer would be induced to buy castings of a particular make simply because he had seen an enamelled sign in a railway station or a poster in a street. The keynote of poster advertising is *the impression of a name* upon the mind in the shortest possible time. The keynote of good casting advertising is, as has already been mentioned, *argument based on facts*. For the ordinary man it may be enough to say "Jones' cocoa," because to him there is so little difference between one cocoa and another that the technicalities of cocoa do not interest him. But for the buyer of castings it is not sufficient to say "Smith's castings," because there is a wide difference between one firm and another in the matter of castings, and he is interested in the technicalities of castings. Posters cannot argue; they can only assert. That is why the founder need not worry much about them.

The size of the advertisements depends on the money the advertiser can afford to spend. It should be remembered that a full page is worth much more than four times a quarter-page; that half a page in the best paper is better in the long run than a full page in the second best; that a big firm needs big spaces if it wishes to retain its prestige; that not to advertise at all is better for such a firm than to advertise meanly; and that the more costly and important the castings, the larger must be the space devoted to advertising them.

The frequency of the advertisements depends also on the length of the founder's purse. It should be borne in mind that continuity is a great advantage if it can be afforded; that 52 weekly advertisements are more than four times as valuable as 13 monthly advertisements; that it is more profitable to appear once a week in one paper than fortnightly in two; and that fortnightly advertisements in the best paper are better than weekly advertisements in the second best.

The form of campaign is a most important matter, and in the next article the twelve best ways of advertising castings will be discussed.

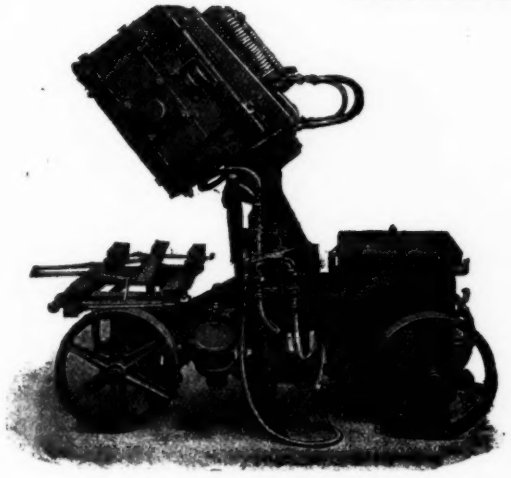
The Industrial Institute has been formed for the study of the fundamental problems of industry. Among the Vice-Presidents and members of the Council are Sir W. Beveridge (London School of Economics), Sir Josiah Stamp, Sir Charles S. Sherrington (President of the Royal Society), Sir Hugh Bell, Sir R. A. Hadfield, Lord Invernairn, Sir William Larke, Mr. Stanley Machin, Sir Edward Manville, Sir F. Mills, Mr. R. T. Nugent, Sir Felix Pole, Mr. J. C. A. Ward, Lord Weir, Mr. G. N. Barnes, Mr. E. Bevin, Mr. J. R. Clynes, Mr. C. T. Cramp, Mr. Vernon Hartshorn, Mr. J. Hodge, Mr. J. H. Thomas, Mr. F. B. Varley, and Mr. A. G. Walkden. The director of the institute is Mr. Norman Wyld, and its offices are at 102, Belgrave Road, S.W.1. The principal object of the Industrial Institute is "to develop a descriptive science of the present working of the industrial system, including production, distribution, and finance, especially from the point of view of the human relations and ethical considerations involved, and to strengthen the foundations of the science of industrial ethics."

MACNAB & CO.

Tabor Patent Portable Combination "Shockless" Jarring Roll-over and Pattern-Drawing

MOULDING MACHINE.

BRITISH BUILT



Box and Mould—after being Rammed—in position of being Rolled over.

Special Features and Advantages.

Sand jar rammed by "Shockless" device—Tabor Patent—without shock to the machine or surrounding moulds.

*** Machine not restricted to use of one size moulding box—any size can be used up to load capacity of machine.**

Good surface castings.

Pattern plates can be changed instantly without unfastening mechanism so that comparatively small quantities can be made economically.

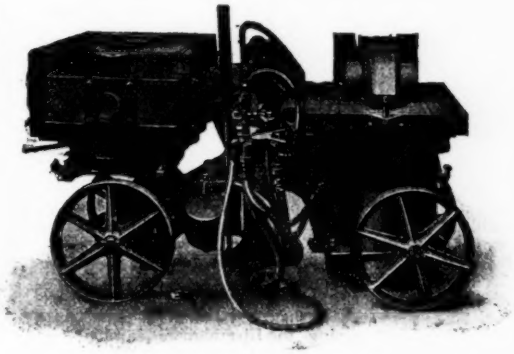
Perfectly straight draw ensured by mechanical guides of large surface to prevent wear and retain accuracy.

All moulds jar rammed in a few seconds and thoroughly uniform in density, ensuring minimum quantity of defective castings and less blow holes.

"All operations other than sand filling are completed in two minutes for any size of work within capacity of machine. To realise what this means, compare your present wage cost for the same work!"

CAPACITY.

SIZE	* Size of Moulding Box.	Straight Pattern Draft.	Nett Weight of load that can be rolled over at 80lbs. pressure.
18	18 in. wide. 36 in. long. 12 in. deep.	8 in.	450 lbs.
24	24 in. wide. 48 in. long. 15 in. deep.	10 in.	800 lbs.



The Finished Mould—showing Pattern after being drawn.

We make various models and sizes for all types of machine moulding, according to class of work and numbers.

SEND US DRAWINGS OF YOUR WORK FOR SPECIFIC EXPERT ADVICE, ... ACCORDING TO YOUR CONDITIONS AND QUANTITIES. .. ..

56/8, EAGLE ST., SOUTHAMPTON ROW, LONDON, W.C.1.

WORKS: TOTTENHAM, LONDON, N.17

Code: Western Union.

Trade Talk.

The Mond Nickel Company, Limited, are removing to Victoria Station House, Victoria Street, S.W.

A blast furnace at Cochrane & Company's Ormesby Ironworks, Middlesbrough, is being blown out this week.

T. J. Grainger & Company, Limited, 31, Side, Newcastle-on-Tyne, have removed to 20, Eldon Square, Newcastle-on-Tyne.

Palmers' Shipbuilding & Iron Company, Limited, have an order for two tank steamers for the Anglo-Saxon Petroleum Company, of London.

A fire destroyed a large part of the premises occupied by Brown & Wilson, brass and iron founders, of 129, Edinburgh Street, Hull, on March 18.

The contract for tram rails for the Manchester City Council has been split up between the United States Steel Products Company, Limited, and three Sheffield firms.

Sir Arthur Steel Maitland, Minister of Labour, has intervened in the wages deadlock in the engineering industry, with the object of again bringing the Employers' Federation and the Trade Unions into negotiation

Workman, Clark & Company, Limited, Belfast, have received an order from Alfred Holt & Company, Liverpool, for the construction of two large vessels each between 450 and 500 ft. long, with a gross tonnage of about 8,000 and a deadweight of upwards of 10,000 tons.

Nasmyth, Wilson & Company, Limited, of the Patricroft Foundry, Manchester, have received orders for ten tank locomotives for the London Midland and Scottish Railway, and for six goods engines for the Bikaner Railway (India) and two small locomotives for the Jodpur Railway (India).

The announcement is made that a well-known marine engineering works on the North-East Coast may have to be closed through trade depression, while a similar works in the same area is to shut down in a month. The works concerned are those of Richardsons, Westgarth & Company, Limited, at Middlesbrough, and Blair & Company, Limited, at Stockton-on-Tees.

It is officially announced by the Great Western Railway Company that the following contracts have been placed: Provision of 30-ton electric "Goliath" crane for Canons Marsh goods depôt, Bristol, Clyde Crane and Engineering Company, Mossend, near Glasgow; supply and erection of an 18-in. hydraulic accumulator at Burry Port Dock, Hollings & Guest, Thimble Mill Lane, Birmingham; renewal of six capstans at Cardiff Docks, Fielding & Platt, Gloucester; supply of locomotive boilers, Ruston & Hornsby, Lincoln, Kitson & Co., Leeds, and the Hunslet Engine Company, Leeds; repair of constituent companies' locomotives, Kitson & Co., Leeds, Kerr Stuart & Co., Stoke-on-Trent, and the Yorkshire Engine Company, Sheffield; erection of new roof for Temple Meads good station, Bristol, John Lysaght, Limited, Bristol.

Obituary.

Mr. W. A. Harper, head of the firm of Harper Bros. & Company, consulting engineers, of 13, St. Helen's Place, E.C., died recently at Funchal, Madeira.

Mr. J. Archdale, whose death is announced at his residence, The Yews, Harborne, in his 86th year, was one of the pioneers of the high grade machine tool trade in the Midlands, and the founder of James Archdale & Company, Limited, of Ledsam Street, Birmingham. Born at Leeds, he had practical experience in various engineering works in Lancashire and Yorkshire. Going to Birmingham in 1861, he was for a period at the machine tool works of Tangyes, Limited. He eventually started business on his own account as a maker of high grade lathes. The business he founded was formed into a private limited company in 1902.

Mr. R. White, who died last week, was the son of the late Robert White, of Glasgow, and was born at Glasgow in 1842. For two years he served with P. & W. MacLellan in the Clutha Works, Glasgow, and later with Robson, Forman and McCall, civil engineers, Glasgow. After a period with several railways, he entered into partnership in 1881 with Sir George Barclay Bruce, engaging in general engineering practice. On the death of his father, in 1908, Mr. White continued the practice of the firm under his own name. In 1919 he took into partnership his chief assistant, Mr. C. Hitchcock, and his son, Mr. B. G. White, and in 1923 his son, Mr. C. R. White, and practised under the style of Robert White & Partners. He was a member of the British Engineering Standards Association.

Company News.

Marshall Castings, Limited.—Capital £10,000 in £1 shares. Manufacturers of castings in aluminium and other metals.

Robey & Company, Limited.—Loss for year, £17,712; debit balance, £26,135; brought in, £13,347; debit balance carried forward, £12,788.

Sir William Arrol & Company, Limited.—Directors unable to recommend payment of dividend due March 31 on preference shares.

Sir W. G. Armstrong, Whitworth & Company, Limited.—Dividend on ordinary shares for half-year, 6d. per share, making 1s. per share for year, less tax.

Corose Brandt, Limited.—Capital £100 in £1 shares. Brassfounders. Directors: J. Cohen, 16, Dunstan Road, London, N.W.11; M. Rose, L. Rose and B. Brandt.

Harland & Wolff, Limited.—Interim ordinary dividend, 2½ per cent.; depreciation, £107,913; further dividend on ordinary shares, 2½ per cent., less tax; carried forward, £125,278.

Gibbons (Dudley), Limited.—Net profit, £18,333; brought in, £14,212; total, £32,545; dividend, 3 per cent., free of tax, on ordinary, making 10 per cent. for year; reserve, £2,500.

Brookes & Company (1925), Limited.—Capital £3,000 in £1 shares. Ironworkers. Directors: A. R. Harrison, 61, Parkside Road, Moss Side, Manchester; T. Ashworth and A. Williamson.

Henry Bessemer & Company, Limited.—Net loss, £6,571; land, buildings and machinery at Bolton sold and loss on realisation charged against general reserve, reducing that fund to £12,641.

Wright & Company, Limited.—Net profit, £3,977; brought in, £4,184; dividend on ordinary shares, 7½ per cent. per annum, making 7½ per cent. for year, with bonus (free of tax) of 6d. per share; reserve, £500; carry forward, £3,186.

Beyer, Peacock & Company, Limited.—Loss for year, £32,869; net loss for period, after providing for interest on debenture stock and reserve for depreciation, etc., £42,508; brought forward, £8,731; amount transferred from reserve account, £50,000; total, £58,731; balance, £16,223; half-yearly dividend on 5½ per cent. cumulative preference shares, £8,250; carried forward, £7,973.

Coltness Iron Company, Limited.—Profit, £211,743; income and corporation profits taxes, £38,000; redemption and depreciation, £40,000; expenses of relining, etc., of blast furnaces and extraordinary repairs to ammonia works, £5,000; brought forward, £26,865; year's dividend on first and second preference shares, £25,750; dividend on ordinary shares for year, 10 per cent.; ordinary reserve fund, £40,000; carry forward, £37,358.

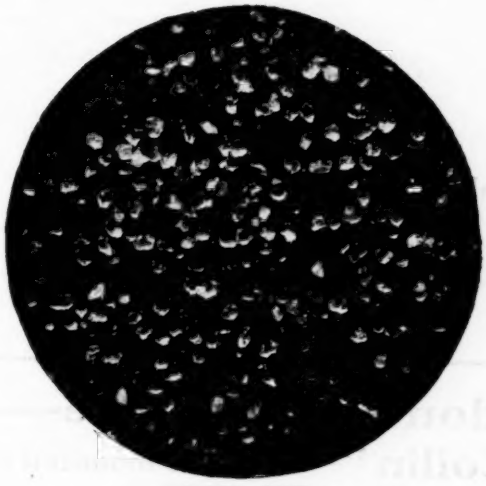
Stewarts & Lloyds, Limited. — Depreciation, £100,000; net profit, £478,960; brought forward, £101,795; total, £580,755; interim dividends, 6 per cent. per annum on preference and 10 per cent. per annum on preferred ordinary shares, £59,000; balance, £521,755; reserve fund, £50,000; employés' benefit, reserve, £10,000; final dividend, 6 per cent. per annum on preference, less tax, £12,788; ditto, 10 per cent. per annum on preferred ordinary, less tax, £32,937; deferred shares, 2s. 6d. per share for year, less tax, £258,768; carried forward, £135,697.

British Insulated and Helsby Cables, Limited.—Mr. James Taylor, J.P., presiding at the 29th annual meeting, said:—During the year 1924 our works have been engaged in their full capacity, and the turnover has been the largest in the history of the company. That the profits have been larger this year than last is due to the increased turnover rather than to a higher average rate of profit. During the year our Prescot works have been running practically night and day, and the night work had been so continuous that the directors decided to extend the wire-drawing and other departments, at a cost of over £250,000. You will be glad to know that, as a result of the company's conservative financial policy in the past, we have funds in hand to meet this heavy expenditure without raising any fresh capital. It is expected that most of the new plant ordered for the above extension will be brought into use during the summer of this year. After a careful study of the probable trend of business in the future, and keeping in view the low prices we have lately had to quote to secure orders, especially abroad, we have provided a special reserve of £150,000 in order to meet these circumstances, and, so far as possible, maintain our business connections. Another reason that we have had in mind in making this provision is to secure as far as may be continuity of employment to our workpeople. In this connection our responsibilities are considerable, in view of the fact that the company now has a total of about 7,700 employés, and the task of keeping them continuously employed grows with increasing business and necessitates persistent effort on the part of all concerned.

The Essential Properties of Sand for Oil Cores

Mr. C. W. Holmes, M.Met., the well-known foundry metallurgist, in his paper on "The Technical Side of Oil Cores," insisted that—

Core sand particles must be rounded and of regular size. Rounded grains give better venting properties than angular grains. Clean sand, i.e., free from clayey matter, requires less oil than do naturally-bonded or dirty sands.



RYARSH SAND.
20 magnifications.

The Ideal Sand for Oil Cores

must be more or less refractory, according to the class of casting to be made, it must be of uniform grain size, and it should be free from clayey material or organic matter.

RYARSH SAND

Possesses all these necessary properties

Full particulars from:

Ryarsh Sand Co., Ltd.

The Quarries, Ryarsh, Malling, Kent.

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IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—It was satisfactory last week that the Cleveland iron trade, after a most exceptional spell of inactivity, developed a much more hopeful outlook. Home consumers, who for a considerable time past have consistently pursued a waiting policy with regard to buying, were coming forward with a substantial volume of inquiries, mostly resulting in actual sales to cover second quarter and later requirements. This welcome change in conditions doubtless resulted from a well-founded impression that prices had about reached the lowest probable levels, and as furnace outputs are now considerably restricted in tonnage, it was thought unlikely that further concessions will be possible. Unfortunately, however, these conditions did not continue long, and this week the market is down again. Sales have again fallen away, and it is now difficult to gauge the future. No. 3 G.M.B. is now down to 77s. 6d., with No. 1 quoted at 82s. 6d., No. 4 foundry 76s. 6d., and No. 4 forge 75s. 6d. per ton.

Unfortunately, the market for hematite does not appear to have shared even in the brief improvement in the foundry grades. The home demand is still reported to be very disappointing, and export inquiry, though better, is still on a comparatively inconsiderable scale. Meanwhile 83s. is a full price for East Coast mixed numbers, with 6d. per ton more for No. 1. In the North-West area prices are unchanged, Bessemer mixed numbers being quoted at 90s. c.i.f. Welsh ports, 95s. per ton delivered at Glasgow, 100s. per ton delivered at Sheffield, and 102s. 6d. per ton delivered at Birmingham.

Metals.

Copper.—The market for standard has recently experienced a slightly favourable reaction from the depressed conditions existing of late, though still lacking the confident tone which tends to stimulate buying on a really substantial scale. There has, however, been a moderate volume of trade buying, and some revival of speculative interest, consumers' policy at the moment being apparently restricted to cautious purchasing. Current quotations :—*Cash* : Thursday, £62; Friday, £61; Monday, £60 2s. 6d.; Tuesday, £60 2s. 6d.; Wednesday, £61 2s. 6d.

Three Months : Thursday, £63; Friday, £62 2s. 6d.; Monday, £61 5s., Tuesday, £61 5s.; Wednesday, £62 2s. 6d.

Tin.—Some slight improvement in the tin position was marked towards the close of the week, selling for the time being having been apparently abandoned. Leading houses are now buyers, while a prominent operator is also taking in tin. Sellers, as a matter of fact, are very cautious; better reports from the States helped the movement. It is obvious that there is not much tin on sale under £250. The Straits shipments for March will be on the small side. Assuming that United States deliveries are up to recent average, there should be a decrease in the monthly visible showing probably 2,000 tons. Current quotations :—*Cash* : Thursday, £247 5s.; Friday, £244 10s.; Monday, £240 5s.; Tuesday, £235 10s.; Wednesday, £240 5s.

Three Months : Thursday, £250 10s.; Friday, £248; Monday, £244; Tuesday, £239 5s.; Wednesday, £243 15s.

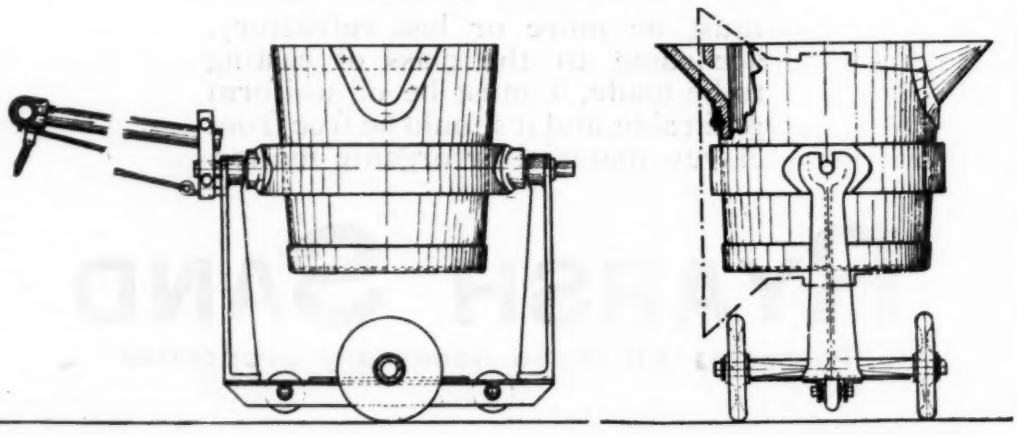
Spelter.—The market for this metal has again developed a weaker tendency, but the general position appears sound enough. At the same time prices are high, and there is nothing to hold them up except the usual manipulation. The dull conditions prevailing among home galvanisers account to a large extent for the decline in values. Offers of metal from the Continent helped the downward movement, but covering by short interests has latterly brought about some recovery. Current quotations :—*Ordinary* : Thursday, £36 10s.; Friday, £36; Monday, £34 17s. 6d.; Tuesday, £34 15s.; Wednesday, £34 10s.

Lead.—The market for soft foreign pig continues quiet and featureless, with values recently inclined to lower levels, though later recovering from the lowest levels. The imports last month, at 19,000 tons, were very moderate, and near lead has been wanted. The premium on the same is fully maintained. Current quotations :—*Soft foreign (prompt)* : Thursday, £35 5s.; Friday, £35 12s. 6d.; Monday, £35; Tuesday, £34 17s. 6d.; Wednesday, £34 12s. 6d.

You don't know me—do you?

I'm a "Collin"—The ladle mounted on roller bearings which tips in two directions. No slag can pass out of the spout and both the spouts can be renewed when necessary.

BUY ME AND TRY ME.



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